

PS-ABX-398

# Nutritional Surveillance

for Disaster Preparedness and Prevention of Nutritional Blindness

## Seasonality of Nutritional Status in Bangladesh

HKI

*Helen Keller International  
Dhaka, Bangladesh*

**A description of the prevalence of undernutrition in 16 rural thanas and 4 urban slums,  
April 1990 - February 1993**

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**Bangladesh Red Crescent Society (BDRCS)**

**Cooperative of American Relief Everywhere (CARE Bangladesh)**

**CONCERN**

**Gono Unnayan Prochesta (GUP)**

**Helen Keller International, Bangladesh (HKI)**

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**International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B)**

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**Rangpur Dinajpur Rural Service (RDRS)**

**United Nations Children's Fund (UNICEF)**

**United States of America Agency for International Development (USAID)**

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## GLOSSARY OF TERMS

### *Nutritional indicators*

The four nutritional indicators used in the NSP describe undernutrition in different ways, and tell us different information. For more detailed information, see the explanatory notes in the NSP Handbook, 1993.

### *MUAC*

Mid upper arm circumference measures the amount of muscle, fat and bone in the arm. It is primarily a measure of recent changes in nutritional status. MUAC <125 mm is a good predictor of the risk of dying in Bangladesh, and selects severely malnourished children.

### *Weight for Height (w/ht)*

This is a measure of wasting and is also considered to reflect recent changes in nutrition. The level “-2 Z scores” selects children below the generally accepted normal range. The term “wasting” is used in the text as shorthand to mean “the level of undernutrition assessed by the prevalence of w/ht <-2 Z scores”.

### *Weight for Age (w/age)*

This is a measure of underweight children, and is a measure of both recent and long term nutrition. Underweight may be the result of wasting, stunting or both. The level “-2 Z scores” selects children below the generally accepted normal range. The term “underweight” is used as shorthand in the text to mean “the level of undernutrition assessed by the prevalence of w/age <-2 Z scores”.

### *Height for Age (ht/age)*

This is a measure of stunting, or children who are too short for their age. Stunting is considered to reflect long term nutritional deprivation. The term “stunting” is used in the text as shorthand to mean “the level of undernutrition assessed by the prevalence of ht/age <-2 Z scores”.

### *Z Scores*

A “Z score” is one way of comparing a child's nutritional status with that of normal, well-fed children. The internationally accepted definition of well-fed children's weights and heights comes from the NCHS reference tables of north American children. These tables are used as the reference in all NSP calculations.

**Note :** Sometimes a different cutoff level is useful. The level “-2 Z scores” selects children below the generally accepted normal range and is used internationally as recommended by WHO. In Bangladesh, stunting and underweight are so common that “-3 Z scores” is relevant to describe the most severely stunted or under-weight children within Bangladesh. This level is not used in this report although in terms of seasonality, it is worth noting that seasonal swings are proportionately greater for this more severely undernourished group.

### *Prevalence*

In this report, it generally refers to the percentage of children 6-59 months old, who are undernourished at a particular time. It may be applied to any of the nutritional indicators, depending on the context.

*Seasonality* means repeating cycles by season, year by year.

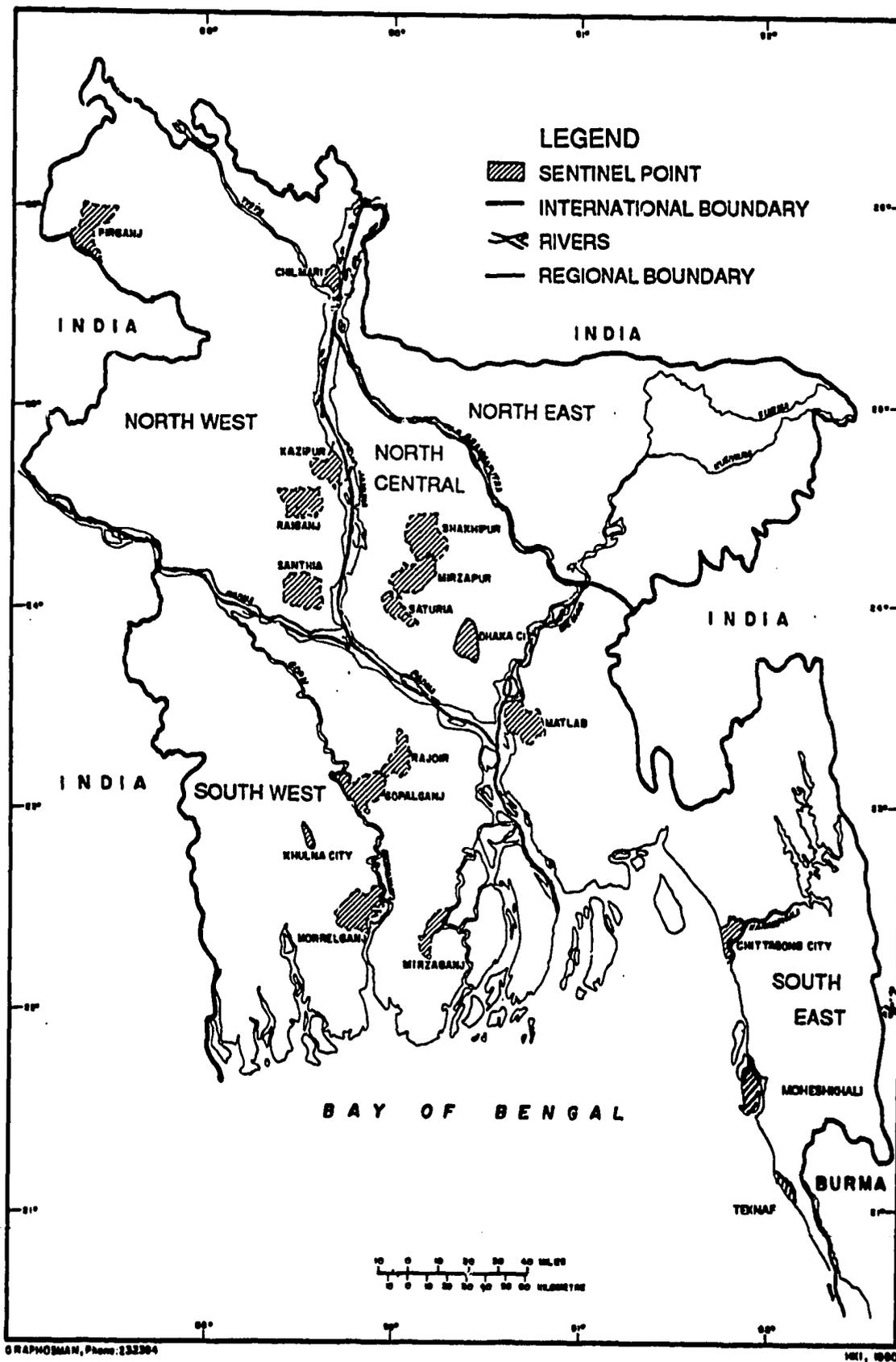
*Trend* refers to longer term changes after smoothing away seasonal cycles, or “de-seasonalising” a graph.

*Thana* is a subdistrict of over 100,000 people in Bangladesh

*Boro* harvest is the harvest of rice in the mid year and *Aman* harvest is at the end of the year.

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**Figure 1**  
*Map of Bangladesh Showing Nutritional Surveillance Project Regions and Sentinel Points*



## Introduction

In Bangladesh, there are clearcut seasons of "wet" and "dry" periods. The monsoon season lasts from June to October and the cooler winter months are November to February. In a society that is highly agrarian, these seasons are important in terms of food production and many other aspects of life. There are times of intense activity and employment, times of relative food abundance, and times of scarcity. The main harvest of rice is the Aman harvest in November - December, and another important harvest is the Boro harvest in April - May. The seasons are also related to the occurrence of infectious diseases, especially diarrhoea which is more prevalent in the rainy season.

Nutritional status is the net result of energy input and expenditure, and is affected by food security, health and care. For children in particular, one can consider nutritional status to depend on access to food by the family, access to food by the child within the family including breastfeeding for the very young child, and on susceptibility to infection. It is therefore not surprising to find that there are seasonal variations in nutritional status in young children in Bangladesh, which coincide with harvests and other seasonal events.

The NSP started with 10 rural thanas (subdistricts) and 4 urban slums in April 1990 and since then, it has expanded to a total of 20 sentinel points. Details of the methodology are available in the Nutritional Surveillance Handbook. In brief anthropometric measurements have been collected on a cross sectional sample of children 6 to 59 months old, every two months. In each round of data collection, 400-500 children have been measured in each thana. Socioeconomic and health information has also been collected. The data collection rounds were in February, April, June, August, October and December each year.

One of the objectives of the surveillance project was to establish a baseline of nutritional status in Bangladesh, including any seasonal patterns. Another objective was to identify any geographical areas of more severe undernutrition. This report describes the nutritional situation in each thana over the period that data has been collected and goes towards meeting these two objectives. Four nutritional indicators have been used to describe the nutritional status in each thana, as each indicator gives different information about nutritional status. This report is basically descriptive and does not attempt to cover the important issue of identifying the determinants of seasonality of nutritional status which will be covered in a later report.

It is important to realise that the nutritional status of young children is an indicator of the well-being of the whole of their community. As such, the nutritional surveillance project provides information on the whole population at a thana level, and seasonal changes in the prevalence of undernutrition of young children reflect times of acute necessity alternating with relatively less hardship that affect the whole community. It is also important to note that while seasonality of nutritional status is present within Bangladesh, even the better seasons have high levels of undernutrition. The same applies to geographic variation. There are differences in nutritional status between thanas, but the overall picture is of widespread undernutrition in all areas.

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## URBAN

*The four urban slums in the NSP were combined as a single data set to give an average picture of the slums in Dhaka Ward 60, Dhaka Ward 62, Chittagong and Khulna.*

The prevalence of wasting showed marked seasonality and a trend to worsening over the 3 years. Stunting showed less pronounced seasonality and an overall trend to a worsening situation.

### *MUAC & Wasting*

There was a higher prevalence of wasting at around 20% in June/August each year, and December/February were the better months at around 10%. In 1991 there was a higher peak in August compared with the other two years, mostly due to a considerable rise in Chittagong and Khulna. These were areas affected by the cyclone of April 1991, and it is likely that the rise in prevalence is related to this. In other areas of Bangladesh, it is interesting to note that many areas showed unexpected improvement at this time. Over the three years, there is a trend to a rise in the prevalence of wasting in the total urban slums. The lean months of August/October showed higher levels in the second and third years, and the best month of February rose from about 10% in 1991 to 13% in 1993.

Undernutrition by MUAC showed a seasonal pattern similar to wasting, with high prevalence around 20% in the mid year, and lower levels around 10%-14% in February. The peak prevalence of undernutrition by MUAC is one round later than the peak prevalence of wasting. While the seasonal recovery in February 1992 was minimal, the recovery in February 1993 was good, coinciding with the effects of good harvests in 1992, including marked reduction of the price of grain in December/February 1993.

### *Stunting & Underweight*

Stunting showed an overall trend to worsening from about 71% to 75% over the three years, although the trend was slowed by a substantial recovery in April 1992. Seasonality of stunting was apparent, with higher levels around December, dropping to a lower level in April each year.

The prevalence of underweight showed definite seasonal cycles similar to wasting, ranging from about 73% in February up to 80% in August/October. There was a trend to increasing levels of underweight over the three years, although there was a substantial recovery in December/February 1993.

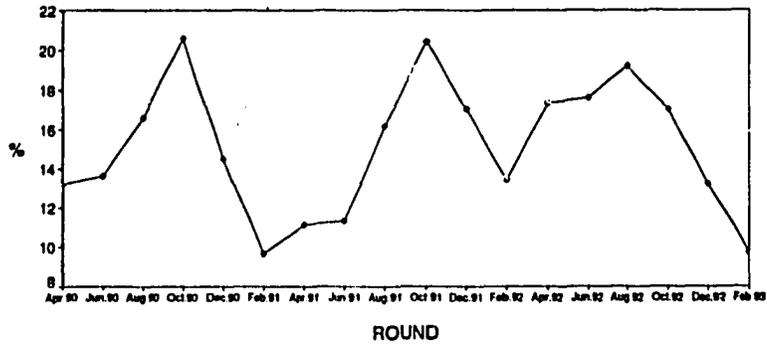
### *Average prevalence of undernutrition (%)*

*(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 14.9                                | 14.9                                | 15.6                                | 15.1                             |
| Wasting             | 14.8                                | 16.3                                | 17.2                                | 16.1                             |
| Underweight         | 72.5                                | 76.5                                | 77.9                                | 75.7                             |
| Stunting            | 71.4                                | 75.5                                | 75.6                                | 74.2                             |

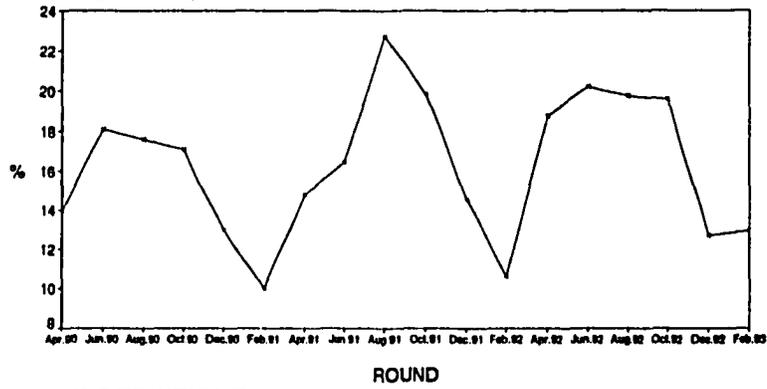
**URBAN: children 6-59 months**  
**MID UPPER ARM CIRCUMFERENCE**

muac: % <125mm



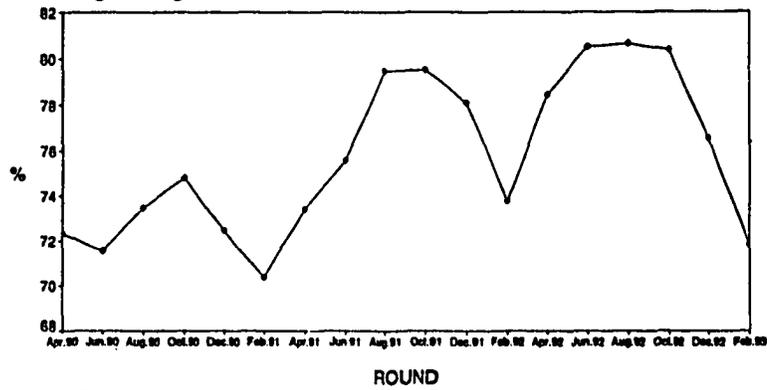
**WASTING**

weight for height: % <-2 Z scores



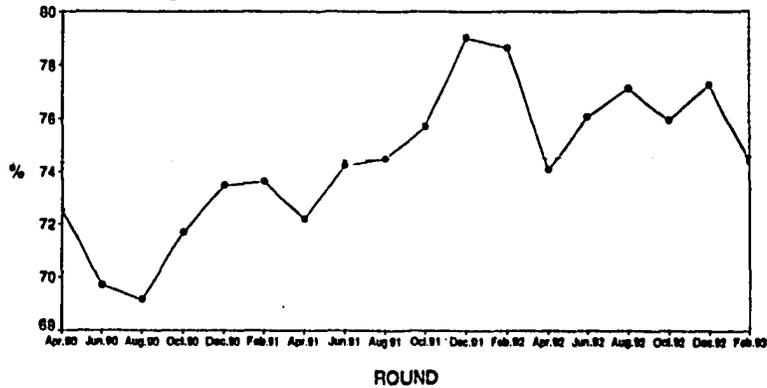
**UNDERWEIGHT**

weight for age: % <-2 Z scores



**STUNTING**

height for age: % <-2 Z scores



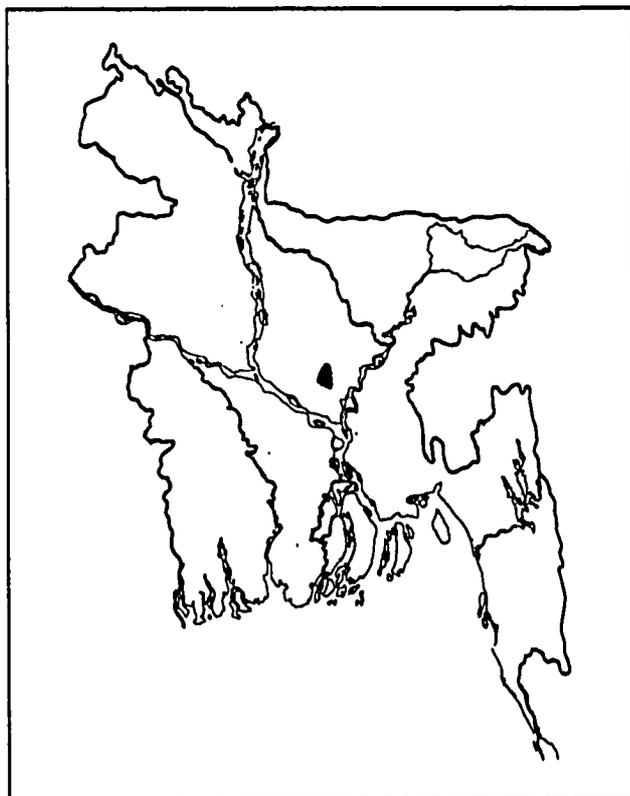
## DIIAKA WARD 60 (Data collected by AKCIIP)

The prevalence of wasting showed marked seasonality and a trend to increasing over the 3 years. Stunting showed a trend to worsening in the first two years then improvement. There are signs of seasonality of stunting.

### *MUAC & Wasting*

Wasting showed marked seasonal cycles with virtually a doubling of prevalence between February and October. There was also a trend to increasing prevalence over the three years; the February level increased between 1990 and 1993, from about 7% to 12% and the level in October also increased each year, from about 17% to 19%.

MUAC showed a typical pattern of seasonality in the first year, peaking at a high 25% in October 1990, and dropping in December/February to about 8%. It remained at a lower level in April/June 1991. MUAC showed little seasonality in 1992, as the expected drop in prevalence in February did not occur, and the level remained fairly constant at about 18% during the whole year. Seasonal recovery was apparent in December/February 1993 however.



### *Stunting & Underweight*

While stunting showed a rather erratic pattern with large changes in prevalence in the first rounds, there was an overall trend to worsening stunting during 1991, when the level rose to about 80%. Improvement occurred in April 1992 and the level hovered around 75% during 1992. While seasonality is masked by such erratically large swings and the longer term trend, higher levels were apparent in December and June each year, and lower levels in April and again in August/October each year.

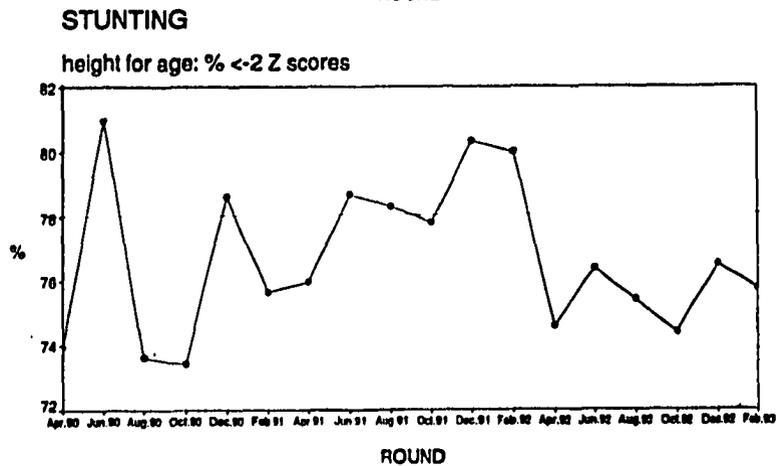
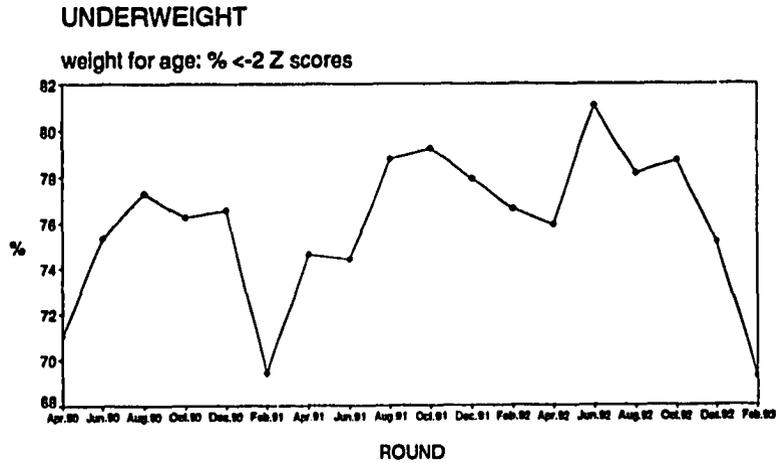
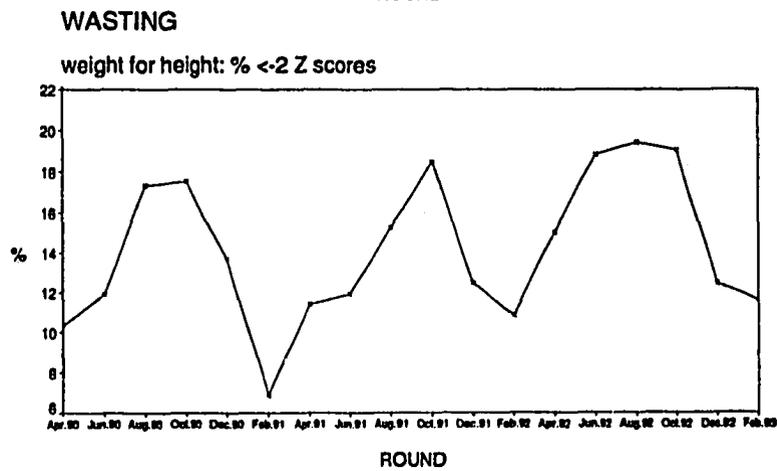
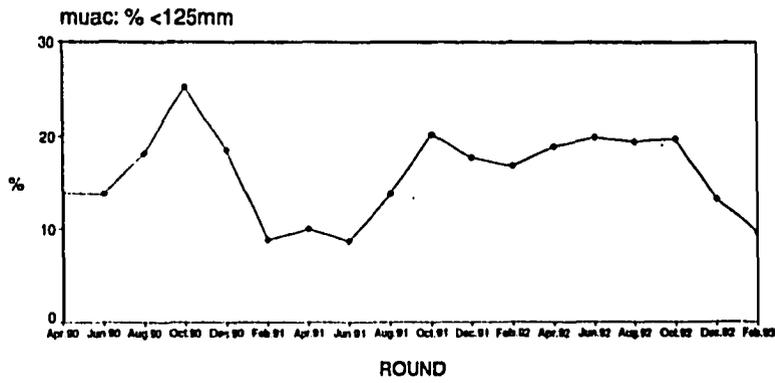
Underweight showed a trend to increasing prevalence over most of the period, peaking at over 80% in mid 1992. Seasonal recovery in February 1993 was better than usual however, the level dropping to about 70%, and this is likely to lead to a slowing of the worsening trend. This good recovery coincided with the effects of bumper harvests during 1992, including considerably lower market prices of grain. The pattern of seasonality was generally similar to wasting, with February being a better month, and higher levels of underweight occurring mid year up to October.

### *Average prevalence of undernutrition (%)*

*(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 16.6                                | 14.5                                | 16.7                                | 16.0                             |
| Wasting             | 13.0                                | 13.2                                | 15.9                                | 14.1                             |
| Underweight         | 74.2                                | 76.8                                | 76.3                                | 75.8                             |
| Stunting            | 75.6                                | 78.5                                | 75.5                                | 76.5                             |

WARD 60, DHAKA: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



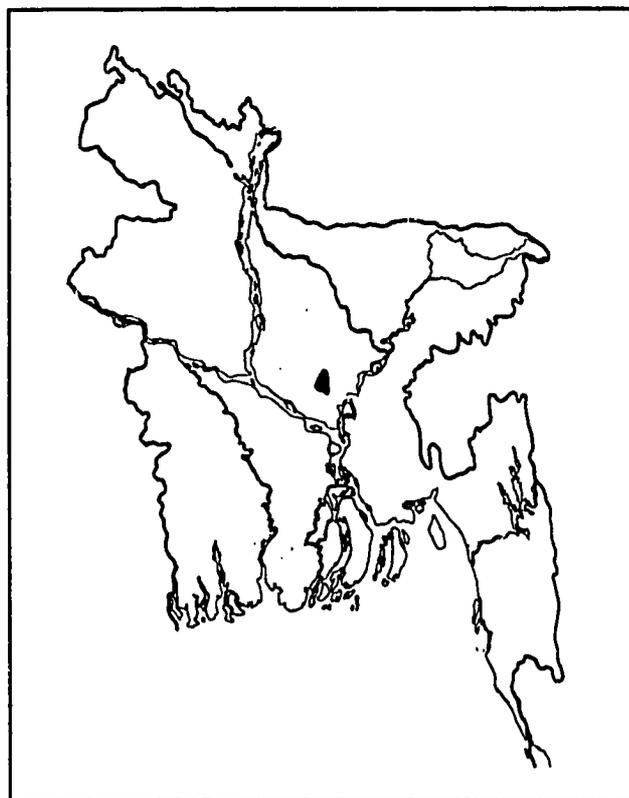
## DIHAKA WARD 62 (Data Collected by AKCIIP)

Data collection began in June 1990. The prevalence of wasting showed seasonality and levels increased during 1992. Stunting showed a worsening trend up to mid 1992, with some improvement after this.

### *MUAC & Wasting*

In the first two years wasting varied seasonally between lower levels in February at around 9%, up to higher August levels around 15%. In mid 1992 wasting remained at a high 25% due to a sharp increase in April 1992, but a good recovery in December 1992 brought the prevalence back to the usual level seen in the "better season". The good recovery occurred when market prices were at a very low level, following the good harvests of 1992.

MUAC followed a seasonal pattern with lower levels around 5-10% in December/February, and higher levels in August/October of 15-20%. There was an uncharacteristic high peak in April 1992, reaching 25% for one round only then dropping sharply to a more usual seasonal level. High levels of both wasting and MUAC occurred in April 1992 coinciding with higher than usual market prices of rice.



### *Stunting & Underweight*

During the first two years, stunting increased from about 60% to 80%, then after August 1992 dropped to about 65% again. Seasonality is not apparent in contrast to other thanas where a seasonal response of stunting can often be seen a few months after changes in wasting

Underweight shows seasonal cycles similar to wasting, and a trend to a worsening situation over the three years similar to stunting. Underweight is affected by both wasting and stunting.

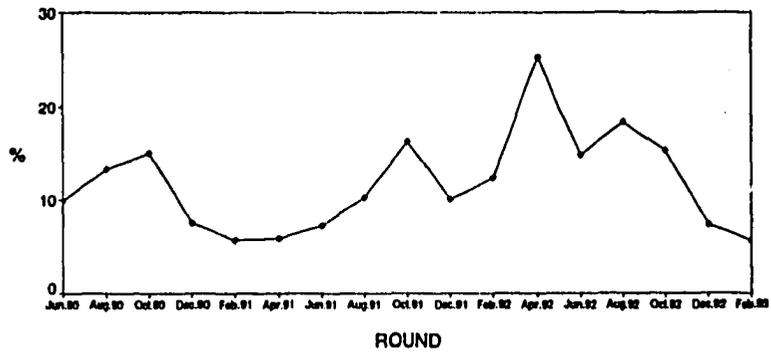
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 9.7                                 | 14.4                                | -                                |
| Wasting             | -                                   | 11.5                                | 18.7                                | -                                |
| Underweight         | -                                   | 67.4                                | 75.0                                | -                                |
| Stunting            | -                                   | 68.8                                | 73.3                                | -                                |

The yearly averages all showed an increase in the level of undernutrition in the 3rd year.

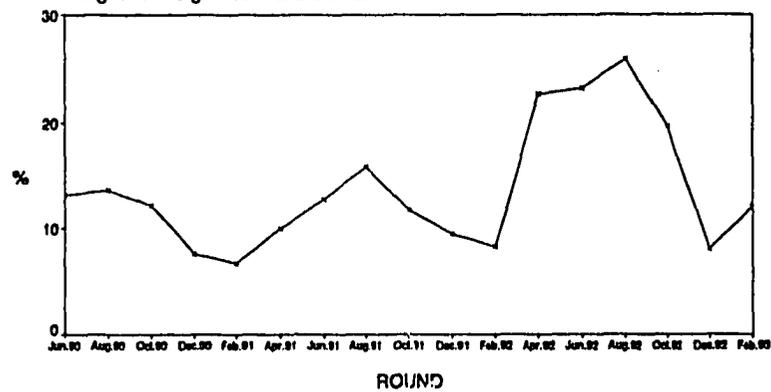
**WARD 62, DHAKA: children 6-59 months**  
**MID UPPER ARM CIRCUMFERENCE**

muac: % <125mm



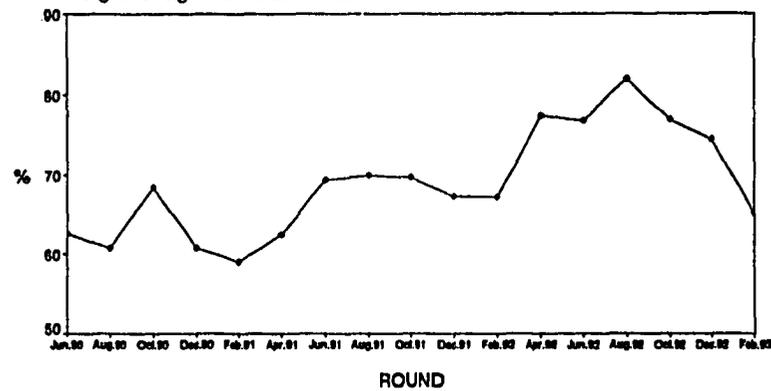
**WASTING**

weight for height: % <-2 Z scores



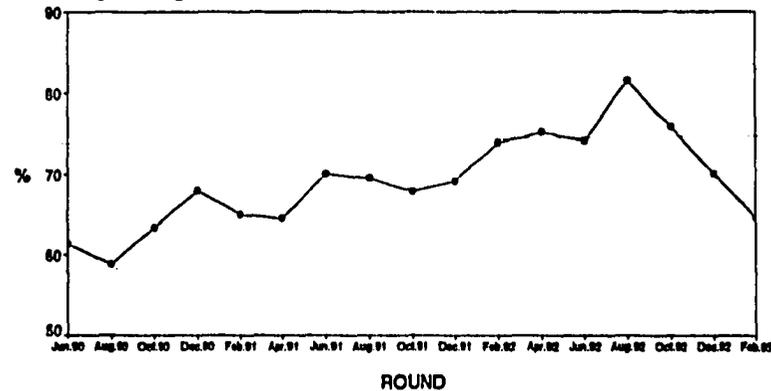
**UNDERWEIGHT**

weight for age: % <-2 Z scores



**STUNTING**

height for age: % <-2 Z scores

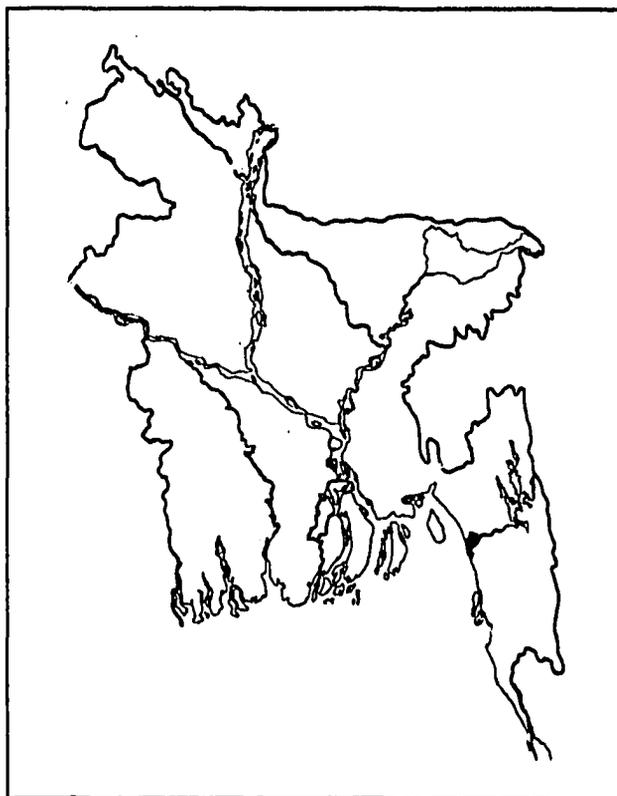


## CHITTAGONG (Data Collected by CONCERN)

Chittagong slum showed marked seasonality of wasting each year and a trend to an overall worsening situation. Stunting also showed a continuing trend to worsening over the 3 year period. Chittagong has extremely high levels of unde. nutrition by all nutritional indicators and is probably the most severely undernourished region in the NSP.

### *MUAC & Wasting*

The level of undernutrition by these two indicators showed pronounced seasonality with high rates of undernutrition in June/August/October and lower rates in December/February. The highest peak level of wasting was in August 1991 reaching a very high prevalence of about 30%, the highest value of wasting ever in the NSP. Prevalence of undernutrition by MUAC was also very high in Chittagong in December 1991 at 27%. This was probably due to the cyclone which battered the region in April 1991. The post Aman harvest period of December/February remained fairly constant throughout the 3 year period at about 10-15% prevalence for both wasting and MUAC. Although these are the better months, they are still at a very high level. The improvement in the post Aman harvest period coincides with lower market prices of food, better wages in February and lower levels of diarrhoea.



### *Stunting & Underweight*

Both stunting and underweight showed a trend to a worsening situation over the 3 year period, rising to a prevalence close to 90% by the end of 1992. Seasonality of stunting was also apparent although this was not marked. Higher prevalence of stunting is seen in October to February and a relatively lower prevalence is seen in the following April. Underweight shows both a trend to a worsening position and cyclical seasonality. This reflects the combined effects of increasing stunting over the 3 years as well as marked seasonal changes in the level of wasting in the pre and post Aman harvest periods..

### *Average prevalence of undernutrition (%)*

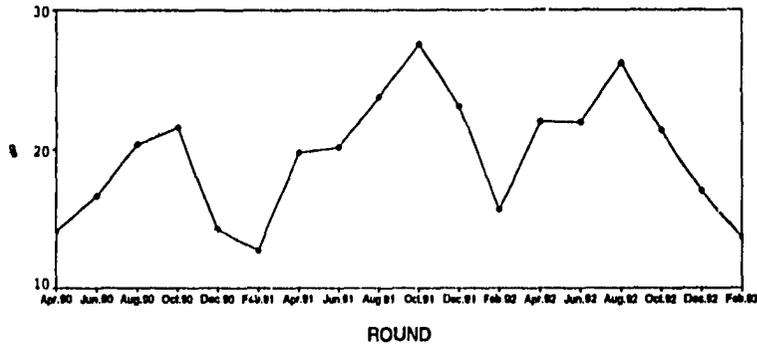
*(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 16.8                                | 21.9                                | 20.3                                | 19.7                             |
| Wasting             | 16.1                                | 20.5                                | 19.1                                | 18.6                             |
| Underweight         | 77.5                                | 83.5                                | 84.6                                | 82.0                             |
| Stunting            | 77.4                                | 80.5                                | 84.2                                | 80.8                             |

The yearly prevalence of all indicators showed a trend to a worsening situation over the three years.

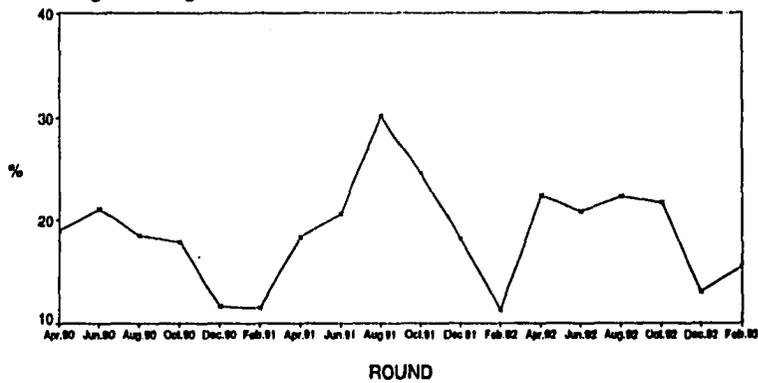
**CHITTAGONG: children 6-59 months**  
**MID UPPER ARM CIRCUMFERENCE**

muac: % <125mm



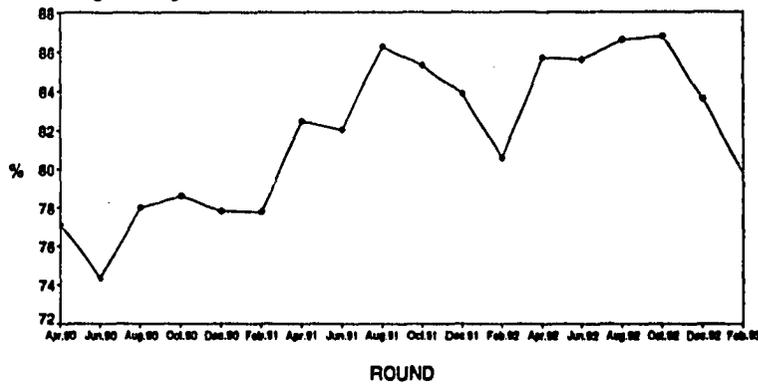
**WASTING**

weight for height: % <-2 Z scores



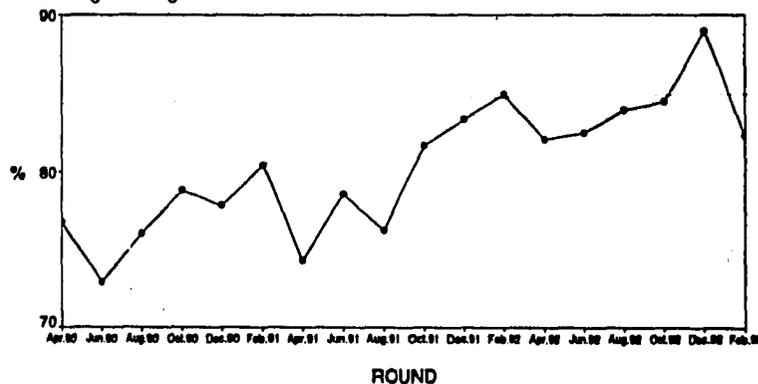
**UNDERWEIGHT**

weight for age: % <-2 Z scores



**STUNTING**

height for age: % <-2 Z scores



## **KHULNA (Data Collected by CONCERN)**

The prevalence of wasting showed marked seasonal changes and a trend to slightly decreasing prevalence over the 3 year period. Stunting showed a trend to increasing prevalence especially in the first 2 years, and seasonal patterns of stunting were not apparent.

### *MUAC & Wasting*

February was the time of least wasting each year. Prevalence of undernutrition by MUAC was also lowest in February. Wasting reached a peak of about 25% in June/August and MUAC reached a peak 2-4 months after wasting each year. However, while MUAC appeared slower than wasting to show seasonal improvement in Khulna, this is not the case in all thanas in the NSP. There is a trend to improvement by wasting and MUAC, especially in the third year. This may reflect the good harvests in 1992, and lower grain prices. The better nutritional status in February coincides with low market prices of food following the Aman harvest, as well as less diarrhoea in February.

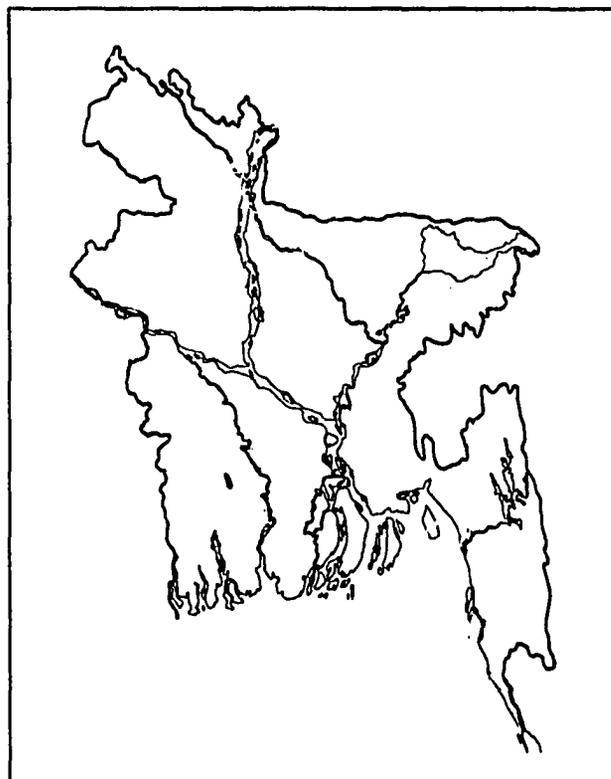
### *Stunting & Underweight*

Stunting increased to over 75% in December 1991 then decreased and levelled off in the 3rd year. The drop in stunting from December 1991, possibly reflects the drop in wasting starting 2 rounds earlier in August. There was a marked drop in underweight in February 1992, due to the drop in the prevalence of stunting and wasting together at this time. Underweight showed a seasonal pattern with lowest prevalence generally in December/February and highest prevalence in August/October.

### *Average prevalence of undernutrition (%) (for definition of indicators, see graphs)*

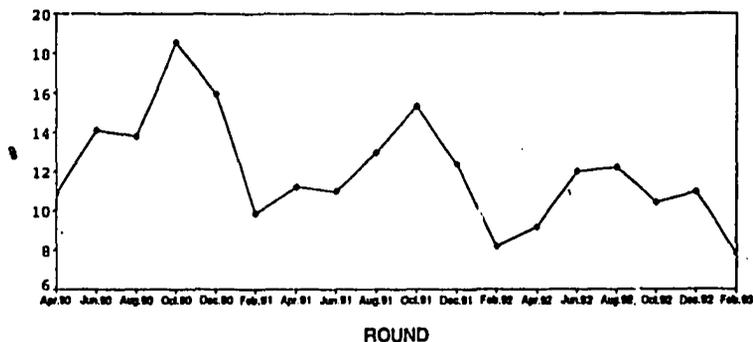
| <b>Nutrition indicator</b> | <b>1st Year<br/>(Apr 1990<br/>-Feb 1991)</b> | <b>2nd Year<br/>(Apr 1991<br/>-Feb 1992)</b> | <b>3rd Year<br/>(Apr 1992<br/>-Feb 1993)</b> | <b>Total<br/>(Apr 1990<br/>-Feb 1993)</b> |
|----------------------------|--|--|--|---|
| <b>MUAC</b>                | 14.1   | 11.8   | 10.4   | 12.0                                      |
| <b>Wasting</b>             | 18.5   | 18.2   | 16.3   | 17.6                                      |
| <b>Underweight</b>         | 72.9   | 74.9   | 74.6   | 74.2                                      |
| <b>Stunting</b>            | 67.5   | 72.5   | 69.1   | 69.7                                      |

The yearly average prevalence of undernutrition by wasting and MUAC showed improvement over the three years. Stunting and wasting averages were higher in the 2nd year.



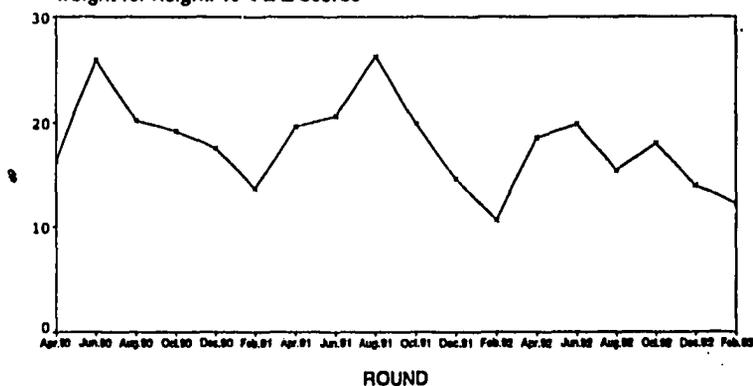
**KHULNA: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE**

muac: % <125mm



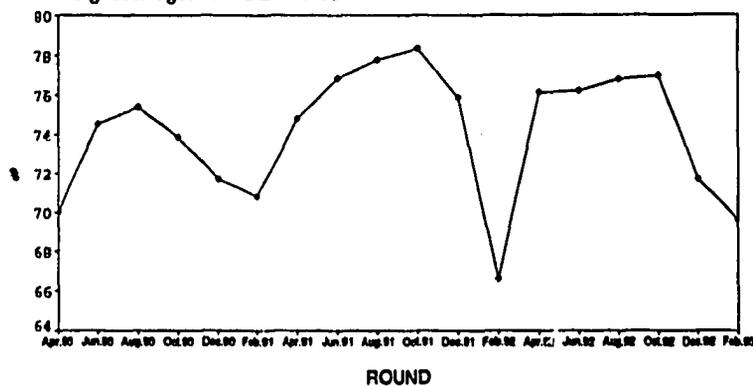
**WASTING**

weight for height: % <-2 Z scores



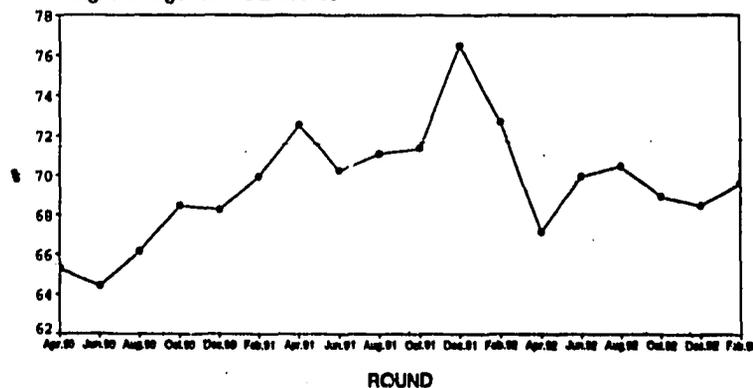
**UNDERWEIGHT**

weight for age: % <-2 Z scores



**STUNTING**

height for age: % <-2 Z scores



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## RURAL

*To give an overall picture of rural Bangladesh, an aggregated sample was made from the ten sentinel points that have been in the NSP since the start of the project. The ten thanas are Santhia, Saturia, Shakhipur, Mirzapur, Gopalganj, Rajoir, Matlab MCH-FP, Matlab extension, Pirganj and Chilmari.*

Wasting showed very marked and repetitive seasonality with a doubling of the number of wasted children in the mid year rainy season. There was no real trend to a worsening or improving prevalence of wasting longer term. Stunting showed a trend to rising prevalence in the first year and a half, then some improvement. Seasonality of stunting is more apparent in the last year.

### *MUAC & Wasting*

The "better months" with less wasting are December/February when the prevalence of wasting is about 10%. All other months are over 15%, the level designated by WHO as "critical". Of these, June and August were generally the worst at around 18% with some improvement occurring by October. Weight for height is generally considered to change fairly rapidly in response to changed nutrition. It can be seen that the better months of December/February coincide with the post Aman harvest period, when food availability is better, the price of food is lower and diarrhoea is less. The drop in the prevalence of wasting between December and February in the last year is very large, reflecting the effects of good harvests in 1992, including considerably lower than usual market food prices. In 1991, the stable situation between April and June coincides with the boro harvest, but it is interesting that in the other two years, there is a rise in the prevalence of wasting at this time. There was an uncharacteristic slight drop in diarrhoea prevalence in June 1991, as well as somewhat lower food prices in all three years in June.

MUAC showed a similar seasonal pattern to wasting, peaking in June/August in the first and third years, with a diminished peak prevalence in mid 1991. There was a trend to worsening in 1992 with a higher peak prevalence of 14% in June 1992, but a substantial recovery in December 1992 brought the level down to the usual "better season" range of about 9%.

### *Stunting & Underweight*

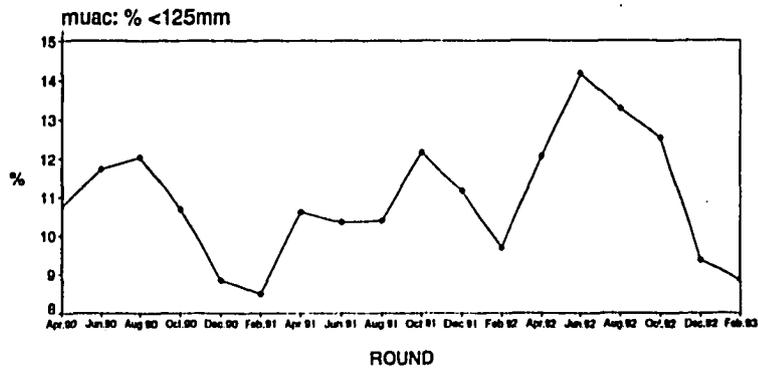
Stunting showed a rise from about 65% to 75% in the first year and a half, followed by a considerable decrease between February and April 1992. There was a seasonal dip in prevalence around April in all years, but this was most marked in the third year. The seasonal stunting pattern follows the cyclical pattern of wasting by about 4 months, reflecting the delayed response of height to nutritional deprivation or improvement.

Underweight followed a seasonal pattern similar to wasting, but also showed a trend to worsening in the first year and a half, reflecting the rising prevalence of stunting at the same time. Wasting and stunting can both influence the prevalence of underweight, as either will result in a lower body weight. Underweight showed a significant improvement in December 1992, due to a drop in both wasting and stunting at this time.

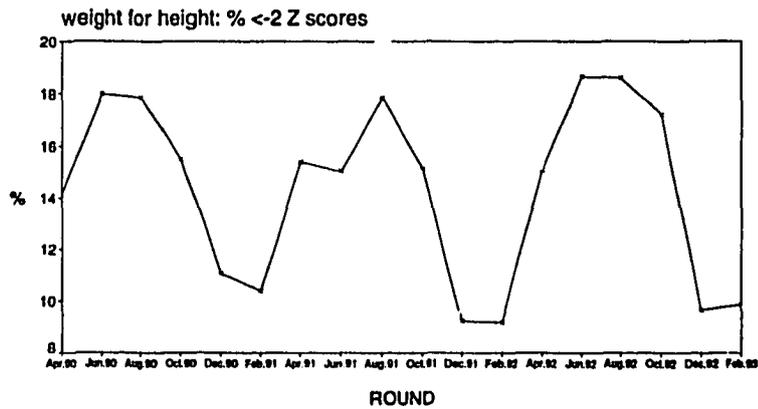
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 10.3                                | 10.7                                | 11.6                                | 10.9                             |
| Wasting             | 14.3                                | 13.5                                | 14.6                                | 14.2                             |
| Underweight         | 69.6                                | 71.8                                | 70.0                                | 70.4                             |
| Stunting            | 68.0                                | 71.3                                | 68.2                                | 69.1                             |

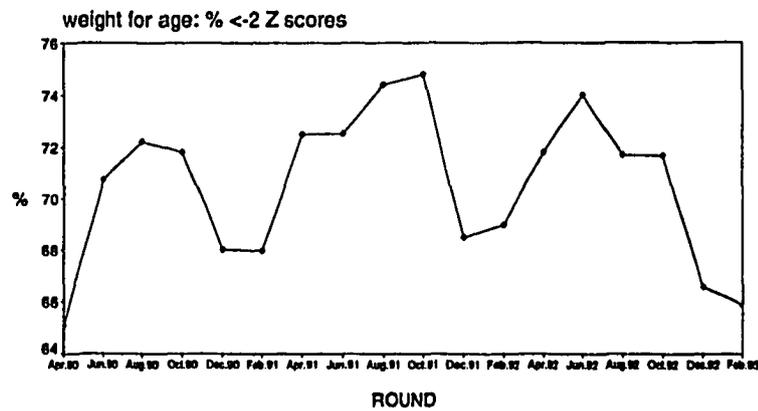
RURAL: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



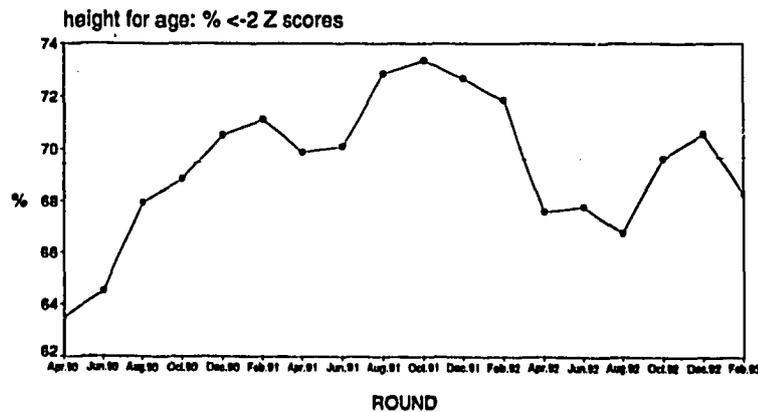
WASTING



UNDERWEIGHT



STUNTING



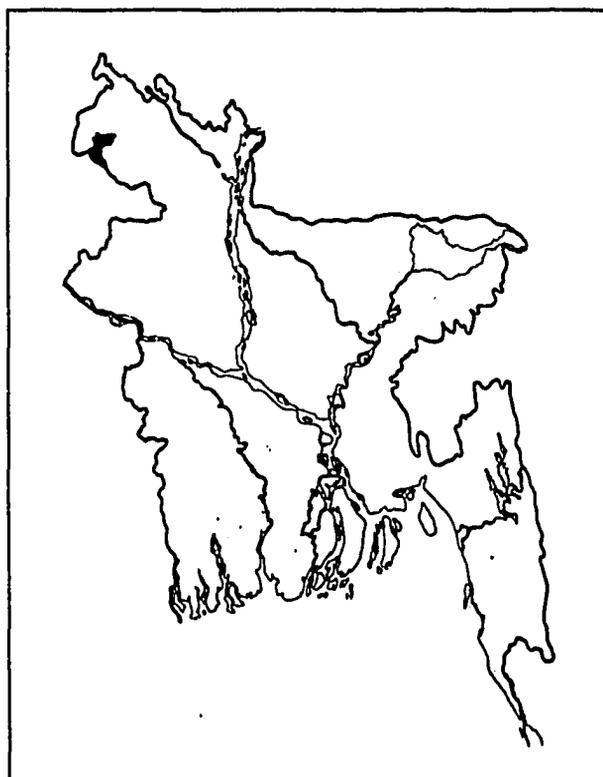
## PIRGANJ (Data Collected by RDRS)

In Pirganj the level of wasting changed seasonally, with higher peak levels of wasting in the first and third years, and a lower peak in 1991. Stunting showed a trend to a worsening situation, up to mid 1991, then a trend to improvement. Stunting tends to be less around June.

### MUAC & Wasting

Wasting showed marked cyclical seasonality with higher prevalence in June/August of about 12-19%, followed by a gradual decline to lower levels of about 7% in December/February. The highest prevalence levels in the first and third year were over 18%, but 1991 had a lower peak around 12%.

MUAC showed a similar seasonal pattern to wasting, although the timing of maximum and minimum seasonal prevalence may differ by one or two rounds. The lower peak prevalence of undernutrition in 1991, by both wasting and MUAC, is in keeping with the pattern seen in other parts of Bangladesh. This may possibly be due to a generalised lower level of diarrhea in mid 1991. It is interesting that the pattern of less severe undernutrition by wasting and MUAC is seen so many thanas scattered throughout Bangladesh.



### Stunting & Underweight

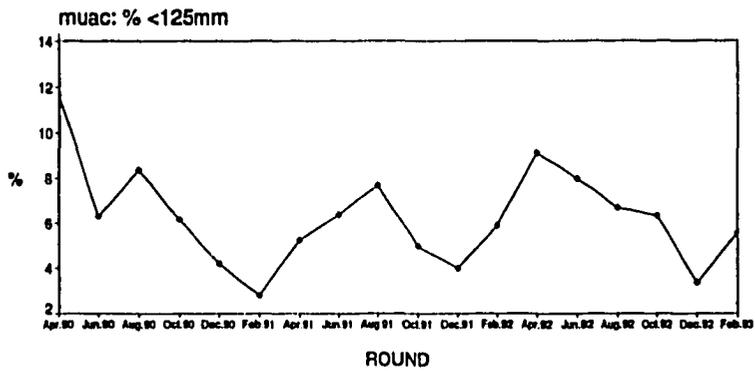
The overall picture of stunting is dominated by a rise in prevalence from about 60% to nearly 80% in the first year, followed by a trend to falling prevalence in the third year to about 60% again. While seasonal changes in the prevalence of stunting were not obvious in each of the three years, seasonality is suggested by a drop to a lower prevalence in June. In October 1991 there is an uncharacteristic and considerable drop in prevalence. It is possible to surmise that maybe the lower peak wasting level in June 1991, contributed to such a sharp decline in stunting some months later. The relationship between seasonality of wasting and the level of stunting is by no means clear, but it is likely that severe nutritional deficit leading to wasting, then subsequently leads to stunting some months later.

### Average prevalence of undernutrition (%) (for definition of indicators, see graphs)

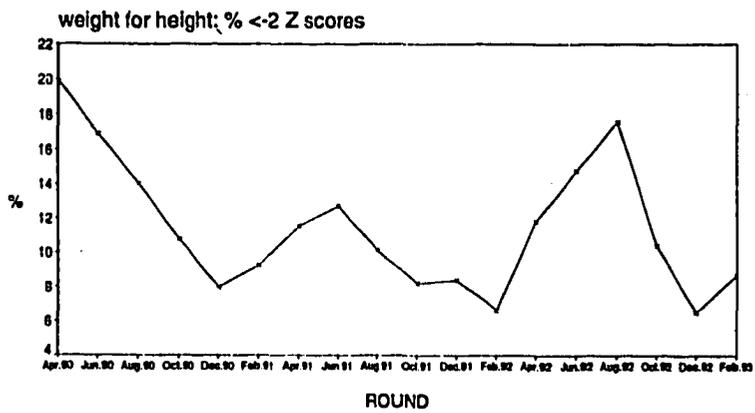
| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 5.9                                 | 5.7                                 | 6.4                                 | 6.0                              |
| Wasting             | 12.2                                | 10.0                                | 11.6                                | 11.3                             |
| Underweight         | 65.8                                | 71.2                                | 62.5                                | 66.2                             |
| Stunting            | 66.5                                | 71.5                                | 59.7                                | 65.5                             |

The yearly average prevalence of undernutrition by MUAC rose slightly during the three years. Stunting and underweight were more prevalent in the 2nd year while wasting was less prevalent in the 2nd year.

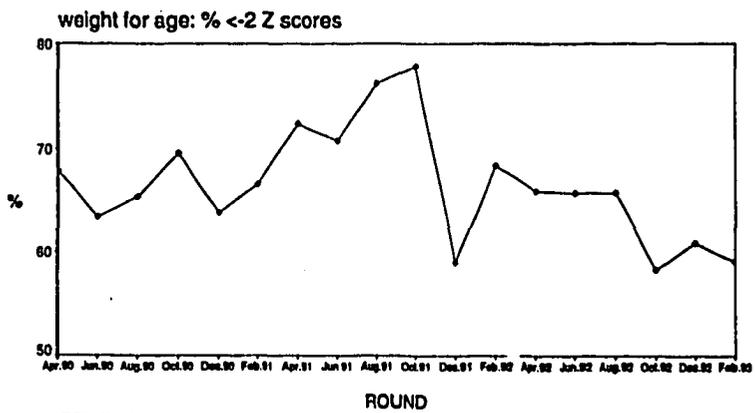
PIRGANJ: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



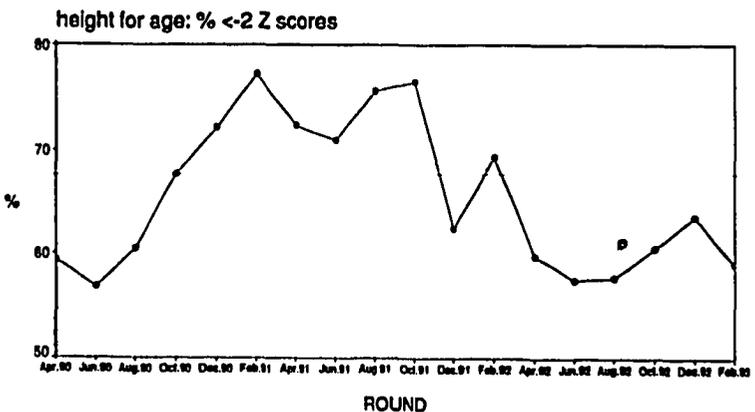
WASTING



UNDERWEIGHT



STUNTING

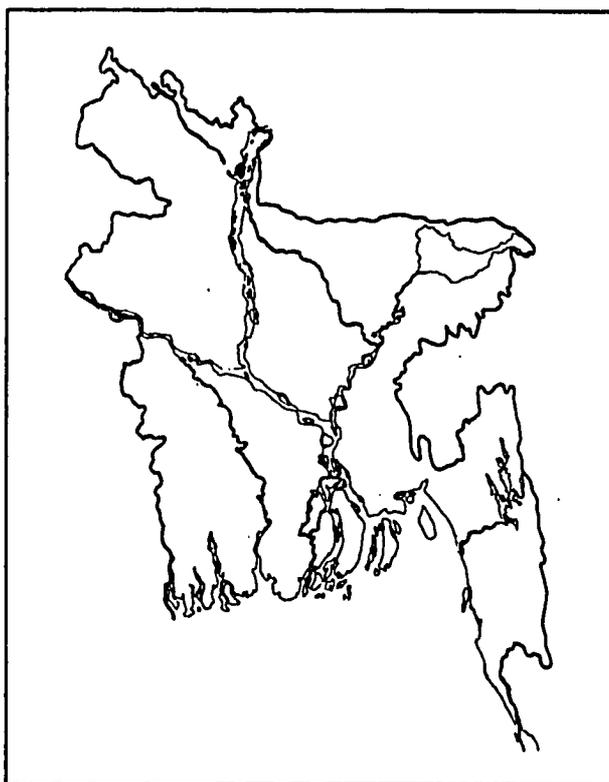


### CHILMARI (Data Collected by RDRS)

During 1990-1991, wasting improved in Chilmari, but stunting worsened. However there was a reversal of these trends in 1991-1993. Patterns showing seasonal changes in the prevalence of wasting and stunting within each year were not so clear at first, but became more apparent in the third year.

#### *MUAC & Wasting*

In Chilmari, both MUAC and weight for height showed similar trends. Initially the level of undernutrition increased to a peak in June/August 1990, then showed a continuing decline until April 1992. In the third year however, there was a low level in February 1992 rising to a seasonal peak in August, then dropping again to a seasonal low in February 1993. In broad terms, the seasonal pattern in the third year is the pattern seen in much of Bangladesh, reflecting the time of pre Aman harvest during the monsoon, and post Aman harvest in December/February. The reason for the lack of seasonal patterns in the first two years is not clear, but the picture suggests that wasting did not worsen in Chilmari in June/August 1991 as would have been expected. In fact there was an uncharacteristic improvement between April and October 1991.



#### *Stunting & Underweight*

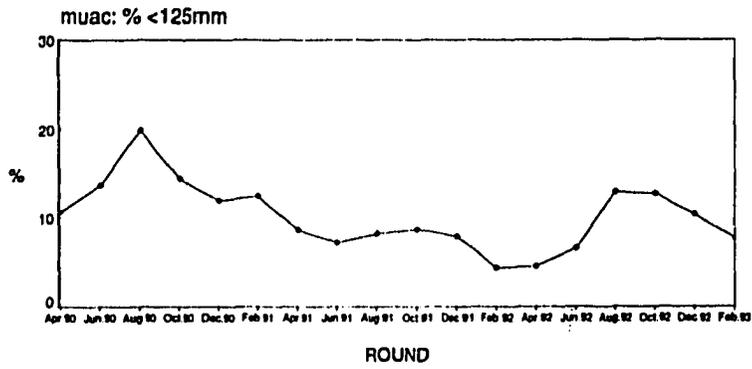
Mirroring the decline of wasting in the first two years, the level of underweight and stunting rose during the same period to reach very high levels close to 90% in October 1991. The interaction between wasting and stunting is not simple but if growth in height is slowed more quickly than weight wasting will show improvements wasting is weight corrected for height. The marked trend to very high numbers of children who are stunted has probably inversely affected the level of wasting. This may partly explain the decline in wasting in Chilmari. Underweight is directly related to stunting, as shorter children weigh less, and the trends of underweight can also be partly explained by the trends of stunting. However, why stunting became so much more prevalent in the first two years, and then improved in the third year is not yet known.

Seasonal patterns of stunting and underweight are not so clear, the picture being dominated by the overall 2 and 3 year trends.

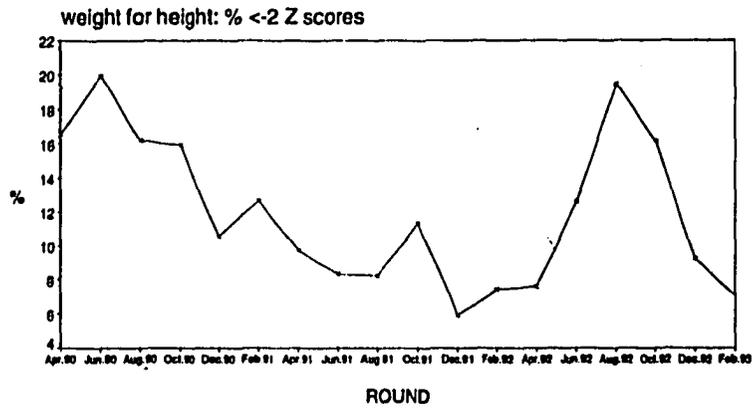
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 14.1                                | 7.5                                 | 9.2                                 | 10.3                             |
| Wasting             | 15.0                                | 8.5                                 | 12.0                                | 11.9                             |
| Underweight         | 73.3                                | 82.0                                | 73.6                                | 76.0                             |
| Stunting            | 73.4                                | 85.8                                | 75.0                                | 77.7                             |

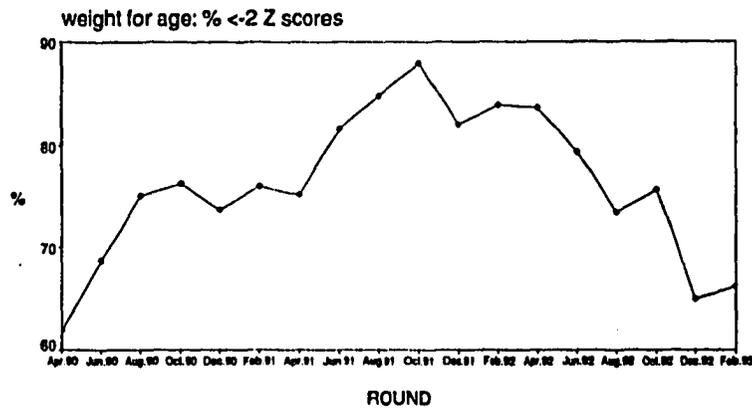
CHILMARI: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



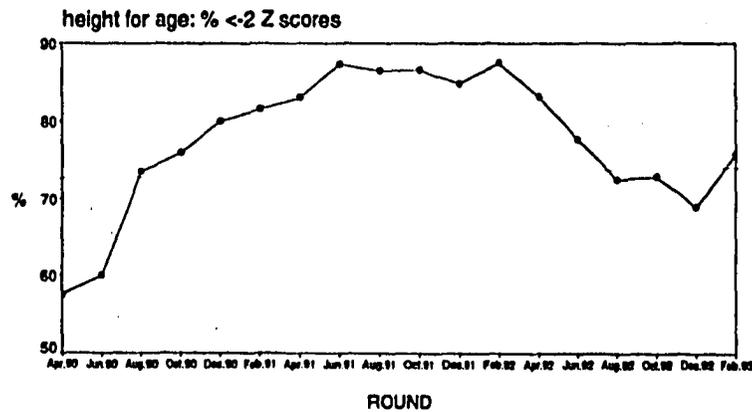
WASTING



UNDERWEIGHT



STUNTING



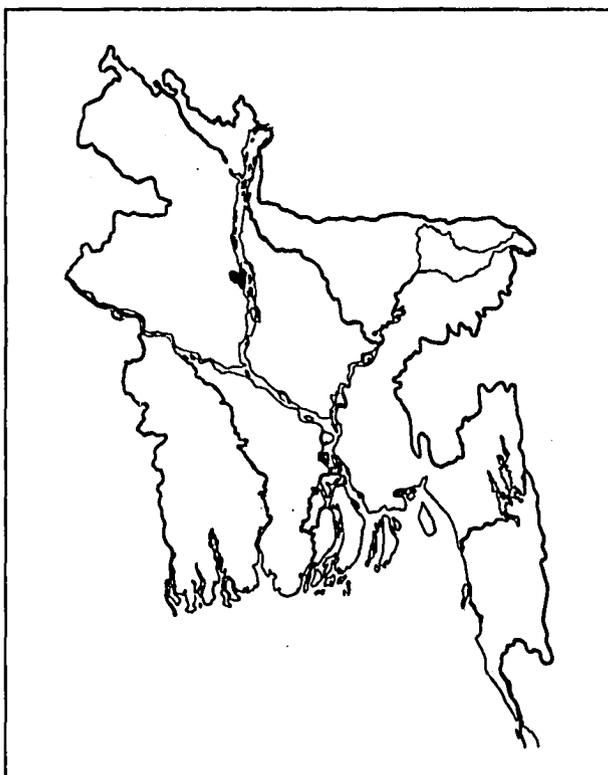
**KAZIPUR (Data Collected by ICDDR,B then PROSHIKA)**

Data has been collected nearly two and half years. Wasting showed cyclical seasonality which was more marked in the second year. There was no longer term trend suggesting increasing or decreasing wasting. There was however, a trend to decreasing prevalence of stunting over the two and half years. Stunting is seasonal in the first year but this is less apparent in the second year.

*MUAC & Wasting*

Lower levels of wasting in Kazipur occurred in December/February, when the prevalence was about 10%. In 1992, the highest level of wasting seen was well over 20% in August. The decline in prevalence between April and June in both years may have been due to the boro harvest. The lower peak prevalence in mid year 1991 was a pattern seen in much of Bangladesh, and there is no definite trend suggesting an increase or decrease in wasting over the two years.

However, there was a trend to decreasing prevalence of undernutrition by MUAC. The pattern in the first year was similar to wasting, but differed in the second year. MUAC and wasting do not necessarily show the same seasonal timing or pattern. Generally wasting is considered the indicator that respond most quickly to change nutritional status. The sharp decline of MUAC in August 1992 was possibly a later manifestation of improved nutrition which was first shown by a drop in the level of wasting between April and June. It is interesting to note that at this time the graphs of MUAC and stunting look similar; both may be showing a more delayed response than wasting to the boro harvest in April/May.



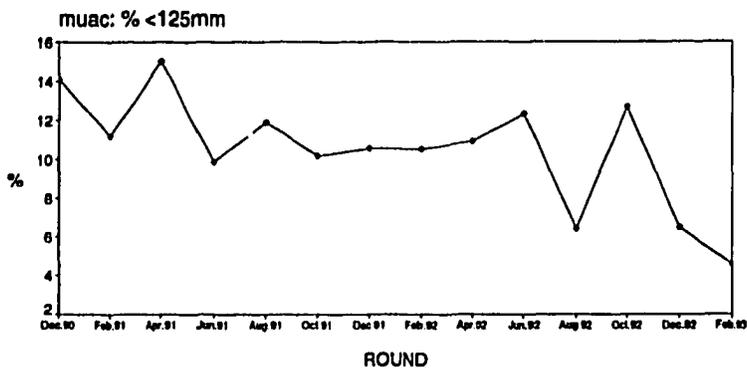
*Stunting & Underweight*

There was a trend to decreasing prevalence of stunting over the two and half years, as the level of stunting dropped from about 80% in December 1990 to about 72% in December 1992. There was cyclical seasonality at first, with highest levels of stunting in December/February and lower levels in the mid year period. In the second year however, there was a rise in prevalence between February and April causing a mid year rise in prevalence. Underweight showed a similar pattern to wasting but also showed decreased prevalence in December/February each year. As stunting showed a trend to a decrease in prevalence, it is to be expected that underweight would show a similar trend, as w/age is related to both wasting and stunting .

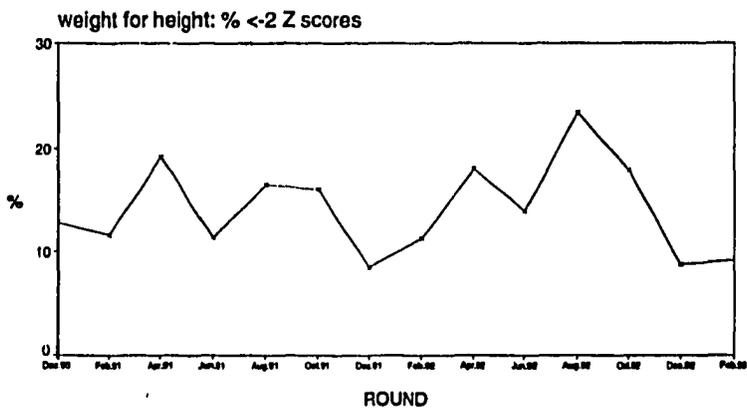
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 11.5                                | 9.0                                 | -                                |
| Wasting             | -                                   | 14.0                                | 13.9                                | -                                |
| Underweight         | -                                   | 72.9                                | 72.7                                | -                                |
| Stunting            | -                                   | 73.7                                | 73.0                                | -                                |

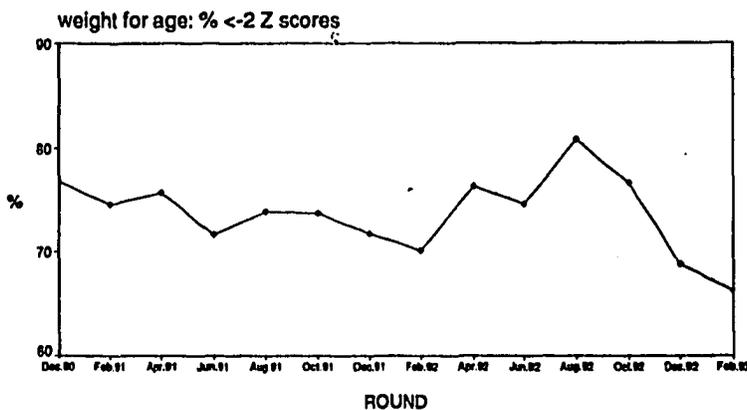
KAZIPUR: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



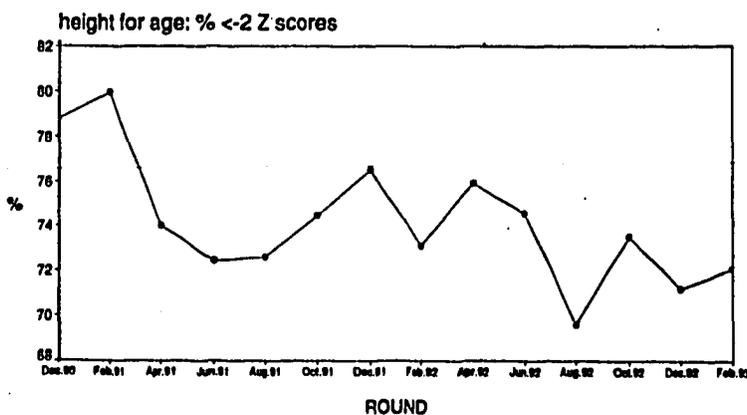
WASTING



UNDERWEIGHT



STUNTING



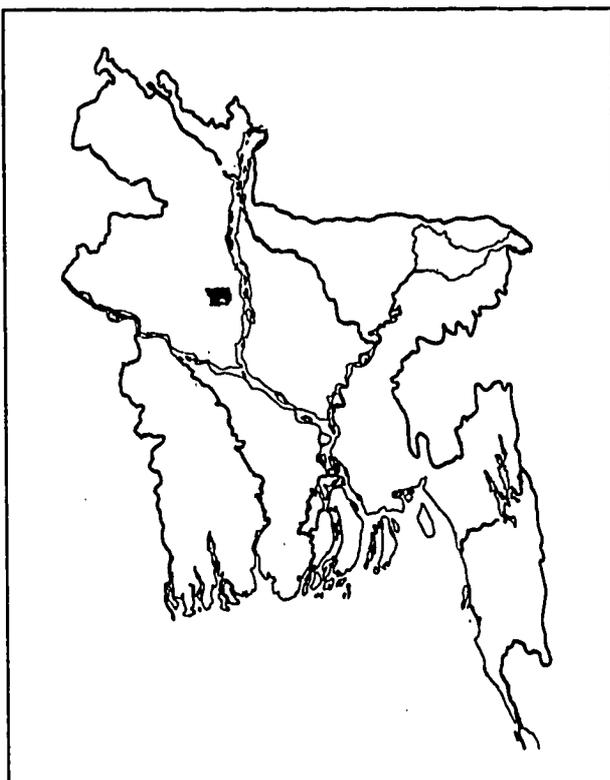
RAIGAN, J (Data Collected by ICDDR,B then PROSHIKA)

Data has been collected for nearly two and a half years. Wasting showed seasonality but there was no definite longer term trend. Stunting was also seasonal. There was a trend to worsening stunting in the first year and a half, then an improvement.

*MUAC & Wasting*

Wasting is least in December/February each year when prevalence hovers around 10%. December 1992 and February 1993 are better than the equivalent months in the preceding two years. The seasonal higher prevalence level is in the mid year rainy season. In 1991 the mid year peak level is lower than in 1992, but both years were still over 20%. In most thanas mid 1991 showed less undernutrition than the other years.

The prevalence of undernutrition by MUAC rose steadily during 1991, peaking in October at close to 18%. Despite a sharp drop in December 1991, the trend to rising levels of MUAC continued in 1992 until a considerable drop occurred between August and December in 1992. This probably reflects the abundant harvest of 1992, with resulting increased food availability and decreased prices.



*Stunting & Underweight*

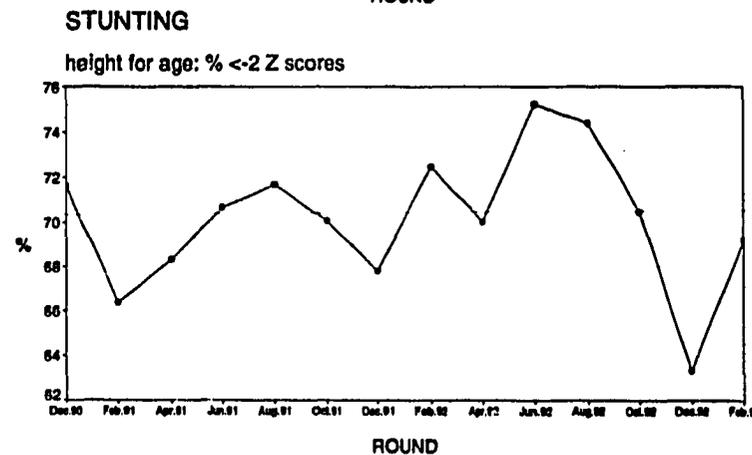
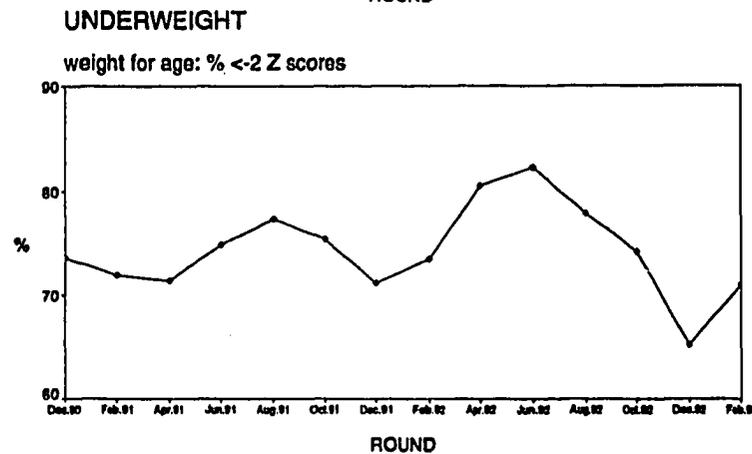
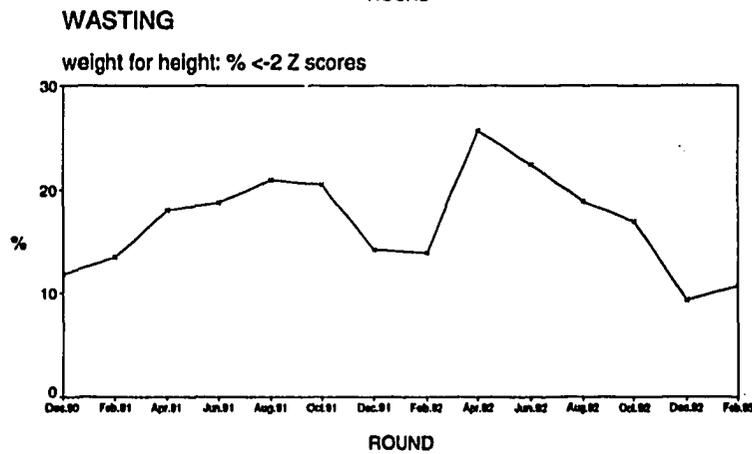
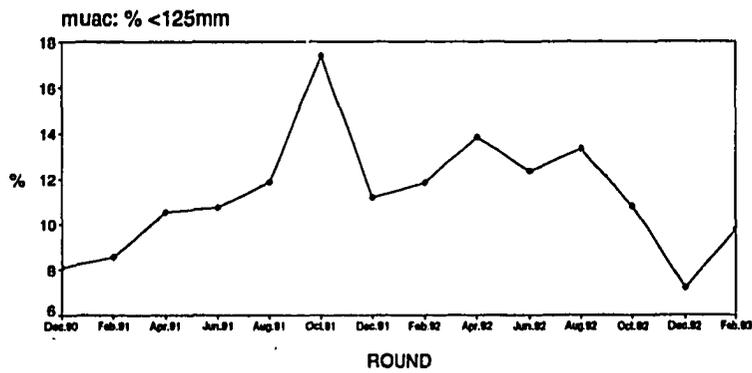
There was at first a trend to increasing levels of stunting up till mid 1992, the prevalence rising from about 65% to 75%. There was however, a considerable improvement in October/December 1992, bringing the prevalence of stunting back down to a lower level. There are cyclical seasonal changes, with stunting prevalence being highest in June/August and lower in February or December. This pattern is surprising as generally, if stunting does show seasonality, the mid year prevalence is less than at other times.

Underweight shows a pattern similar to wasting, with seasonal high prevalence in June/August and lower prevalence in December/February. The peak prevalence was highest in the second year at over 80%, and improvement is seen in December 1992 reaching the lowest value of about 65%. The drop in underweight in December 1992, is partly due to the drop in stunting at this time.

*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 12.0                                | 11.1                                | -                                |
| Wasting             | -                                   | 17.7                                | 16.7                                | -                                |
| Underweight         | -                                   | 73.6                                | 74.7                                | -                                |
| Stunting            | -                                   | 70.0                                | 70.4                                | -                                |

RAIGANJ: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



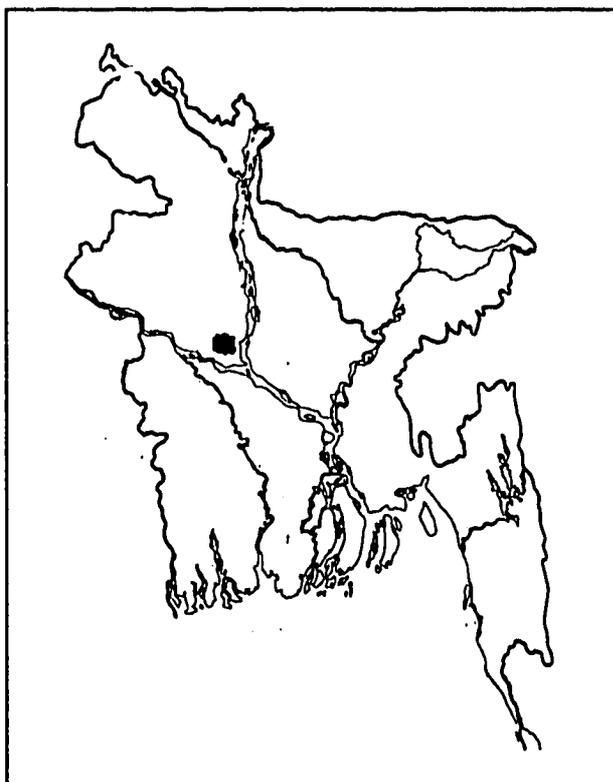
**SANTHIA** (Data Collected by BRAC)

Wasting showed pronounced seasonality but no consistent longer term trend over the three years. Stunting also showed seasonal cycles, and a downward trend suggesting some improvement in the last two years.

*MUAC & Wasting*

Wasting was lower in December/February each year, at about 7%. Highest levels were around August at about 16%, with October showing some improvement in two of the three years. In the first two years the period April to June was basically stable, coinciding with the boro harvest. In the third year however, when the boro harvest was good, there was an increase in wasting at this time.

MUAC showed a trend to increasing prevalence during 1991 peaking at about 20% in June 1992. This was followed by improvement leading to a low prevalence of 6% in December/February 1993. This period was characterized by a considerable fall in market food prices, which reached lower levels than usual for this time of year. In 1991, the mid year period did not show much seasonal rise in the prevalence of undernutrition by MUAC. In the third year, a more typical pattern was seen with a high mid year level of undernutrition by MUAC, and lower levels in the post Aman harvest time in December/February.



*Stunting & Underweight*

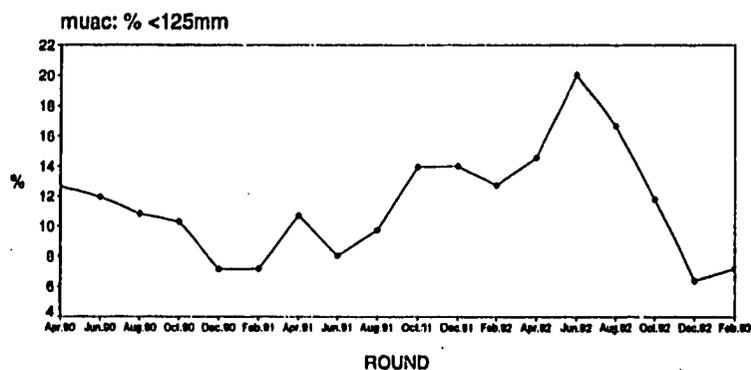
Stunting showed definite seasonality, although the degree of change was not so large. Higher prevalence over 70% was seen around December each year, and lower levels around 65% were seen in the middle of the year. The upward and downward seasonal swings in the prevalence of stunting follow a few months after similar swings in the prevalence of wasting. This is because measurable changes in height generally take longer than the other indicators to respond to changes in nutritional balance. There is a considerable drop in the prevalence of stunting in February 1993 following two months after the equivalent fall in the prevalence of wasting.

Underweight shows a seasonal pattern similar to wasting ranging from about 62% to 72%, and a slight downward trend in the last year.

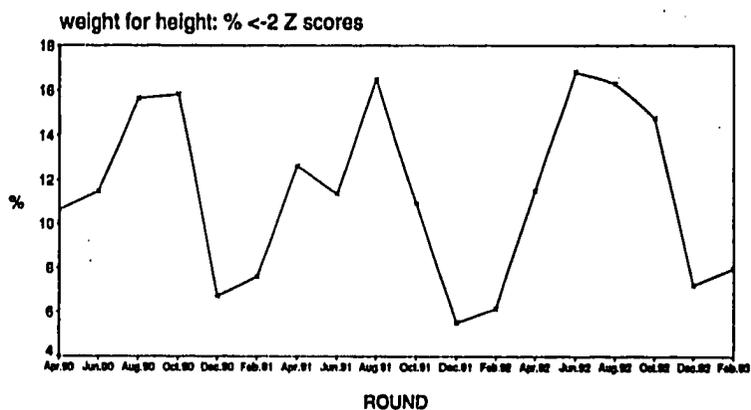
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 9.8                                 | 11.5                                | 12.5                                | 11.3                             |
| Wasting             | 11.3                                | 10.4                                | 12.2                                | 11.3                             |
| Underweight         | 67.6                                | 69.1                                | 66.3                                | 67.6                             |
| Stunting            | 70.3                                | 68.9                                | 66.9                                | 68.7                             |

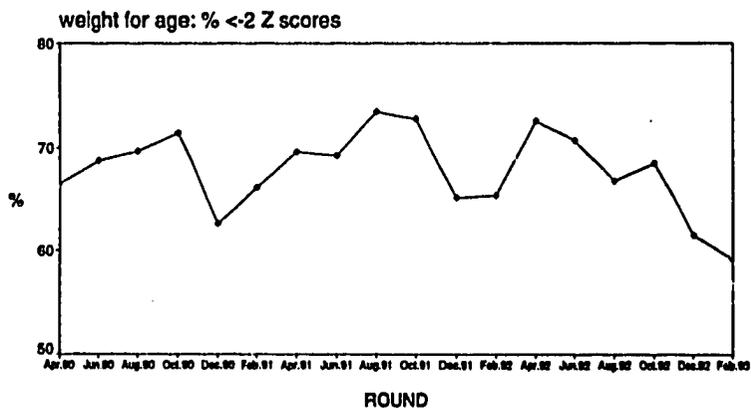
**SANTHIA: children 6-59 months**  
**MID UPPER ARM CIRCUMFERENCE**



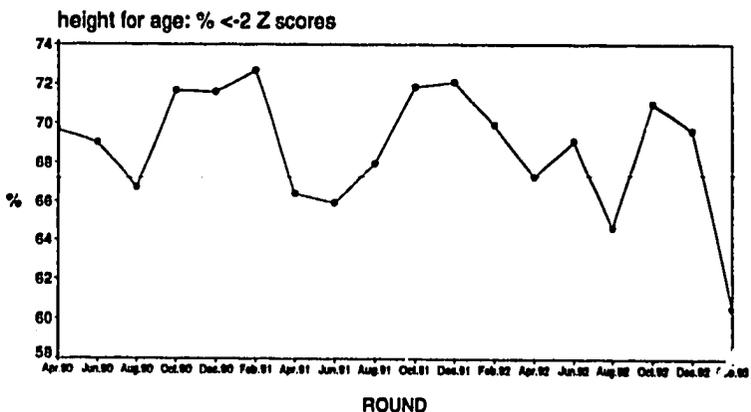
**WASTING**



**UNDERWEIGHT**



**STUNTING**



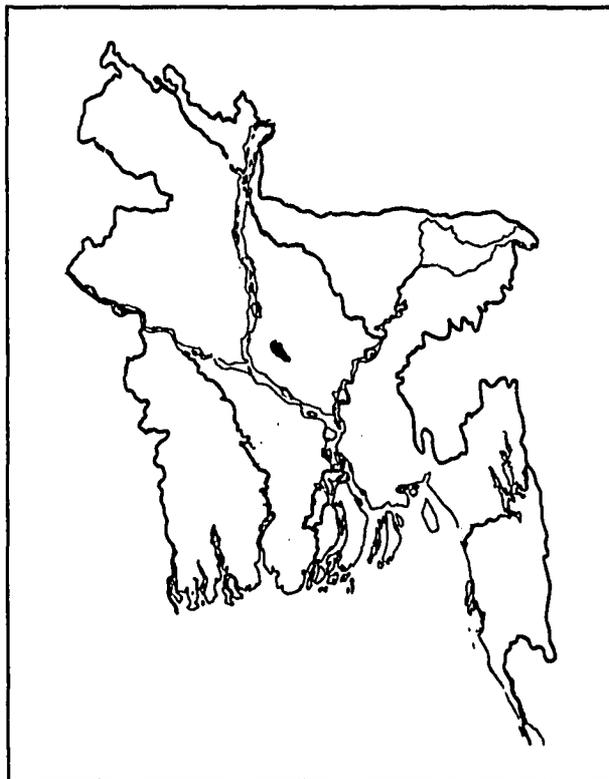
## SATURIA (Data Collected by BRAC)

Wasting showed seasonality with a double peak each year, and a trend indicative of increasing undernutrition by wasting. Stunting showed a trend to a worsening situation, and also shows seasonal cycles which are more apparent in the last two years.

### MUAC & Wasting

Wasting was least in December/February at about 8% and then showed a first peak in April or June, followed by a second peak around 20% in August or October. The double peaks occurred each year and the drop between these peaks coincides with the boro harvest. There was an increase in the prevalence of wasting in the "better season" of December/February with each passing year.

MUAC showed seasonality in the second and third years, demonstrating a pronounced double peak similar in timing to wasting. The results in the first year were erratic, and seasonality was not apparent in 1990. In the first few months there was a steep drop in prevalence to a low level about 8%, and this was followed by a slowly worsening trend up to 15% until some recovery occurred in December/February 1993.



### Stunting & Underweight

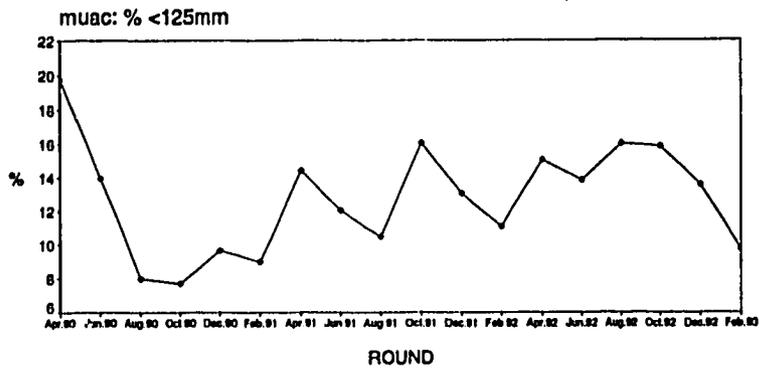
Stunting showed a trend to increasing prevalence over the three years with the level of stunting climbing to nearly 80% by December 1992. There was a seasonal cycle suggested by a lower prevalence around August, and a higher prevalence around December. The cycles lagged about 2-4 months behind the seasonal cycles of wasting, reflecting the more delayed response of stunting to nutritional balance, compared with the rapid changes in wasting.

Underweight also showed a trend to increasing prevalence, and especially the better season values in December/February, rose from about 65% to 70% over the three years. Seasonal cycles were seen, and followed a pattern similar to wasting with a double peak being apparent in the third year.

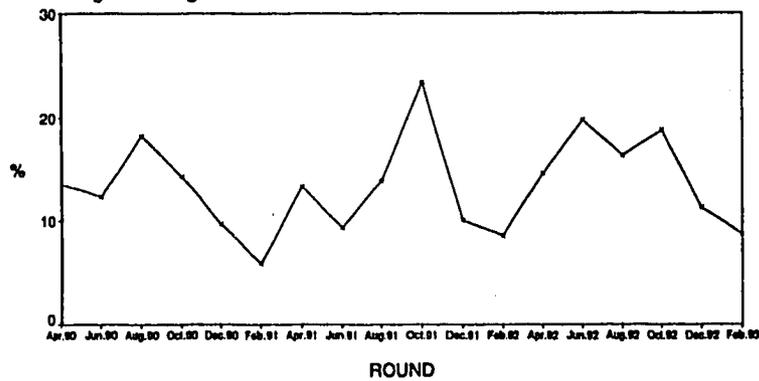
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 10.6                                | 12.8                                | 13.9                                | 12.4                             |
| Wasting             | 12.2                                | 12.6                                | 14.6                                | 13.2                             |
| Underweight         | 69.5                                | 70.5                                | 72.6                                | 70.9                             |
| Stunting            | 68.3                                | 71.6                                | 73.5                                | 71.1                             |

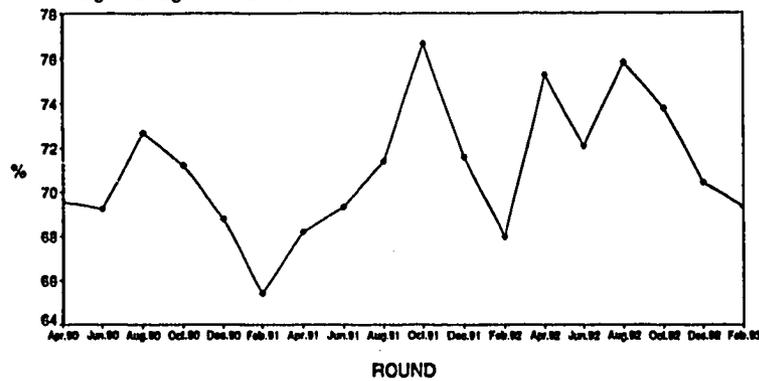
**SATURIA: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE**



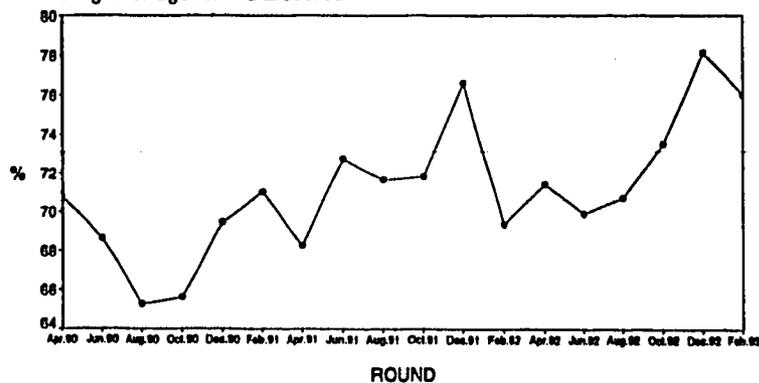
**WASTING**  
weight for height: % <-2 Z scores



**UNDERWEIGHT**  
weight for age: % <-2 Z scores



**STUNTING**  
height for age: % <-2 Z scores



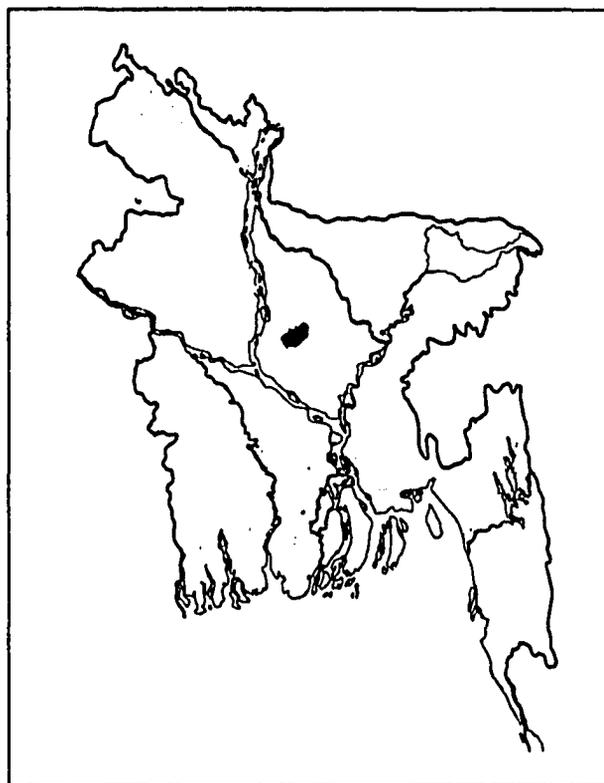
## MIRZAPUR (Data Collected by CARE)

Wasting showed cyclical seasonality but no consistent longer term trend. Stunting showed some evidence of seasonality in the first two years, and a trend to improvement in the third year.

### MUAC & Wasting

The level of wasting showed a clear seasonal pattern in the first and third years, but the expected rise in June 1991 did not occur, and in fact there was a drop in prevalence at this time. In the first and third years, wasting peaked at about 20% in June/August and had improved by October, reaching lowest levels of about 10% in December/February. The pattern of seasonality of undernutrition by MUAC is similar although seasonal cycles are less obvious than those seen in wasting. An unexpected rise in undernutrition by MUAC occurred in December 1991, following a large drop in October.

The uncharacteristic patterns seen in mid 1991 were also seen in other parts of Bangladesh, as many thanas showed less seasonality in 1991, compared with the other two years.



### Stunting & Underweight

Seasonality of stunting is not very obvious, but there is a pattern of a rise in levels in February in the first two years. There was a lower level of stunting recorded in April 1990, but then stunting remained at about 68% until the last year, when there was a trend to less stunting.

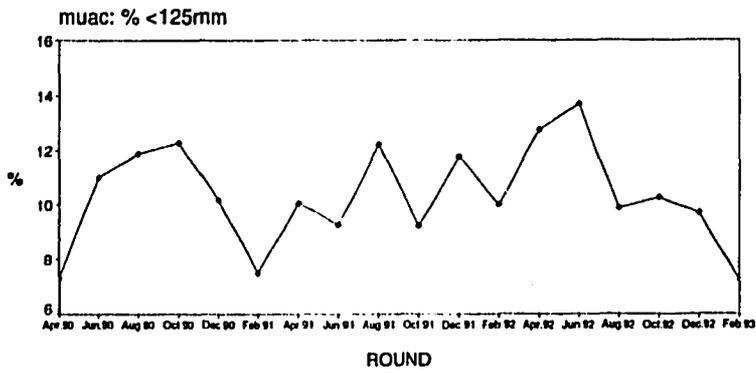
Underweight prevalence showed a seasonal pattern similar to wasting, with a sharp decline in prevalence in December 1990 and August 1992, that correspond with the decrease in stunting at these times.

In all graphs, there is an improvement in undernutrition in December 1992 and February 1993, that reflect low grain prices and increased availability of food following the large harvests in 1992. Diarrhoea prevalence was also low among the nutritional surveillance sample in February 1993.

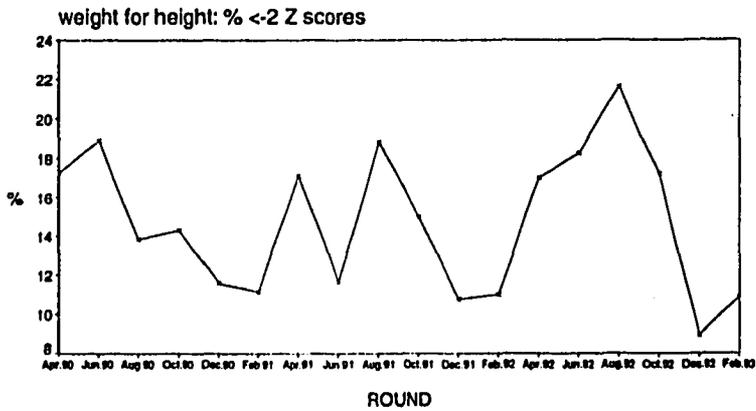
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 10.2                                | 10.4                                | 10.5                                | 10.4                             |
| Wasting             | 14.1                                | 13.9                                | 15.3                                | 14.4                             |
| Underweight         | 68.7                                | 69.3                                | 66.6                                | 68.3                             |
| Stunting            | 66.3                                | 68.9                                | 61.8                                | 65.9                             |

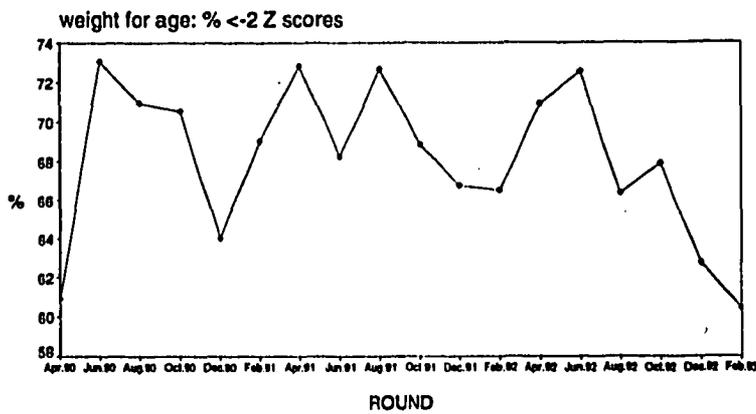
MIRZAPUR: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



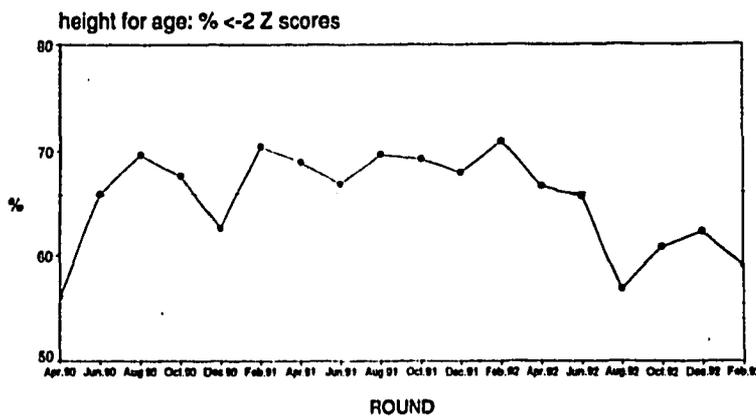
WASTING



UNDERWEIGHT



STUNTING



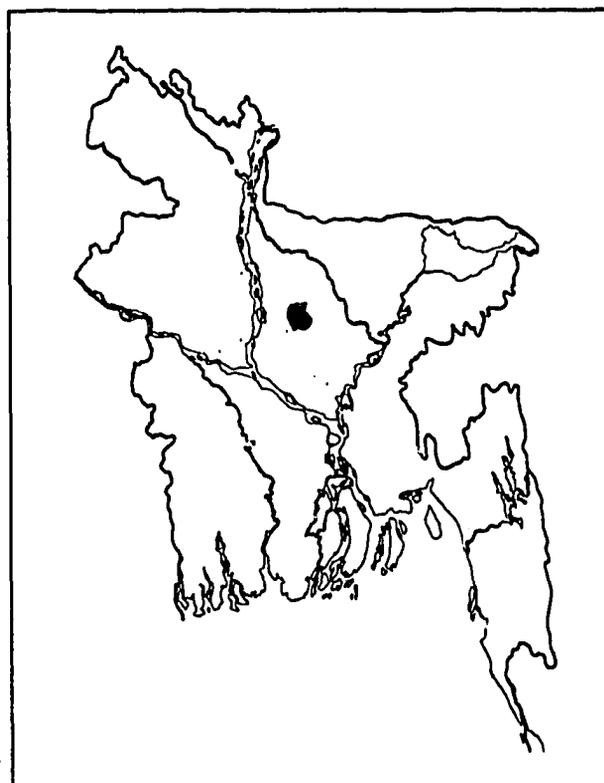
## SHAKHIPUR (Data Collected by CARE)

Wasting showed seasonal cycles, and 1992 was slightly worse than the previous two years. Stunting showed a trend suggesting improvement over the three years, and also showed seasonality.

### *MUAC & Wasting*

Wasting showed marked seasonality with swings from about 15% in December, to over 25% at the mid year peak prevalence. The peak high levels occurred somewhat earlier than in many other thanas, with improvement being seen by October in all three years. This suggests that the boro harvest may be relatively more important in this thana. The lowest prevalence was in December with a rise starting by February, suggesting that the aman harvest has a less lasting effect in Shakipur compared with many other thanas.

The level of undernutrition by MUAC showed a more erratic pattern than wasting, but still December was a better month in all years, when prevalence was about 9%. In contrast to wasting, the highest prevalence of about 14% occurred in October in the first two years, and in June in the third year. In the third year there is a drop in prevalence of MUAC in February, which coincides with a marked drop in market prices following very good harvests in 1992.



### *Stunting & Underweight*

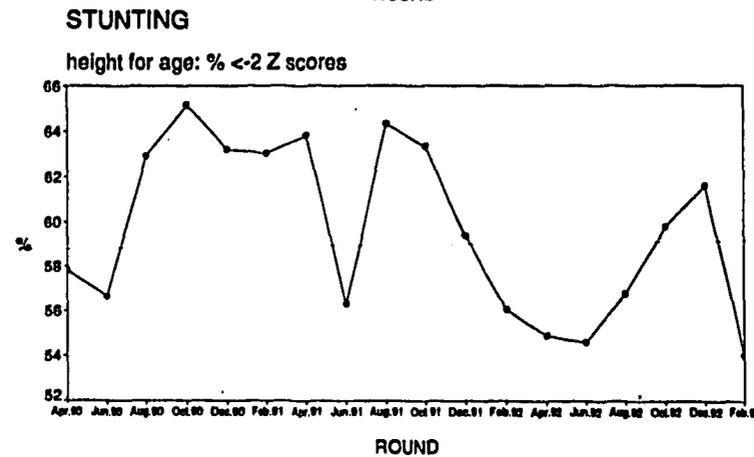
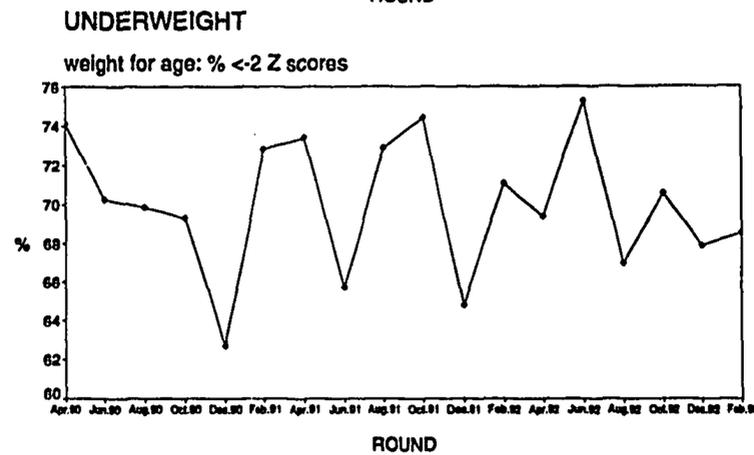
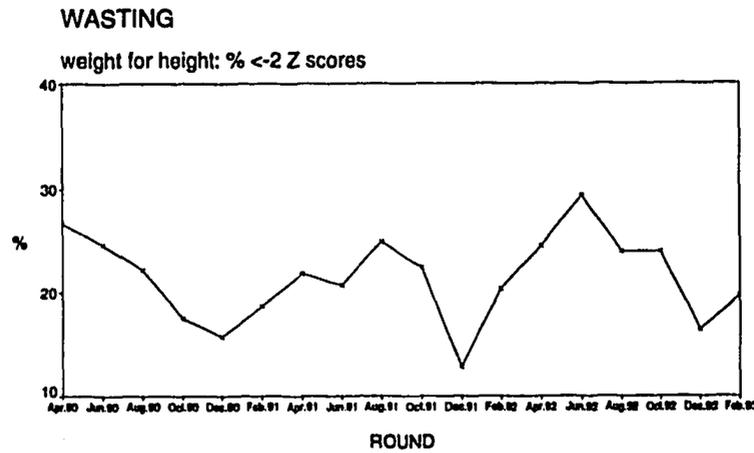
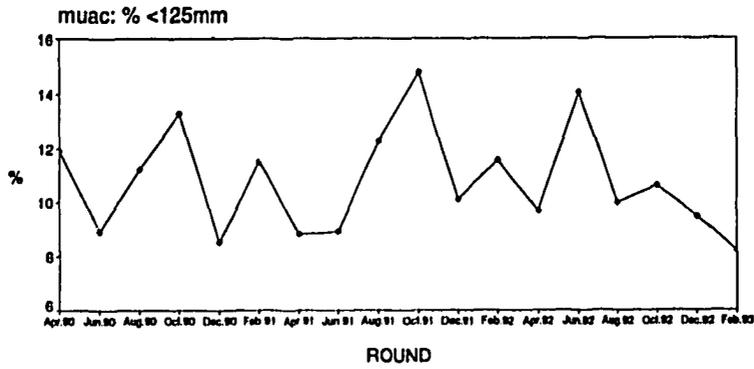
Stunting was at a lower level of about 55% in June each year and October/December were at a higher level around 60-65%. However, apart from this pattern, seasonal cycles were not smoothly repetitive. The large dip in prevalence in June 1991 with high levels in the preceding and following rounds, was different from the gradual fall and rise in prevalence around June 1992. There is a suggestion of an overall trend to decreasing prevalence of stunting.

Underweight showed an erratic pattern similar to MUAC. In each year however, December was still better month although it was followed by a worsening situation in February. This is in contrast to most other thanas where February is often the best month. Improvement between October and December was seen consistently each year, also suggesting a cyclical seasonal pattern. The mid year period was characterized by an unpredictable pattern, which differed each year. The large drop in underweight in June 1991 is due to the large dip in the level of stunting at the same time, plus a concurrent dip in the prevalence of wasting, as underweight is affected by both wasting and stunting.

*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990-<br>Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 10.9                                | 10.9                                | 10.2                                | 10.6                             |
| Wasting             | 20.2                                | 20.3                                | 22.6                                | 21.0                             |
| Underweight         | 69.5                                | 70.4                                | 69.7                                | 69.7                             |
| Stunting            | 62.0                                | 60.4                                | 57.0                                | 59.7                             |

SHAKIPUR: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



## MORRELGANJ (Data Collected by IPIIN)

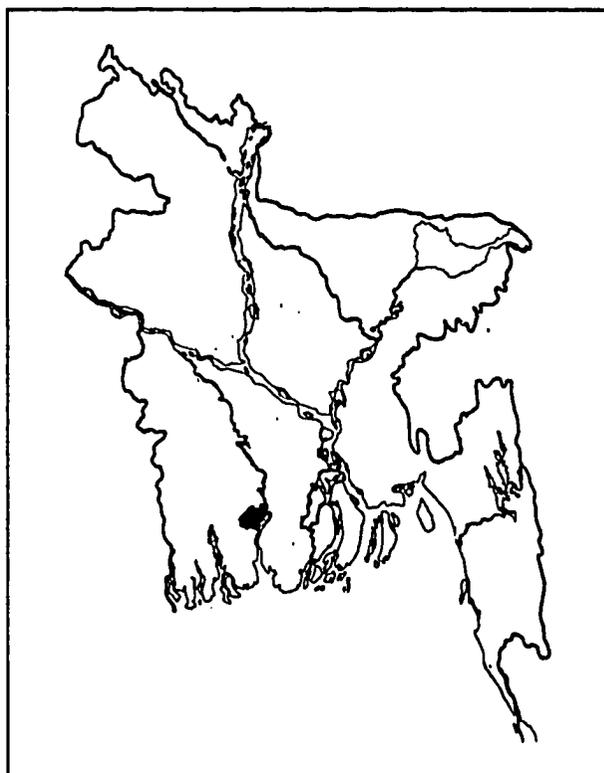
Data was collected for two years. Both wasting and stunting were worse in the 2nd year. Wasting showed definite seasonality. Stunting showed some evidence of seasonality.

### MUAC & Wasting

Wasting shows peak high levels around 20% in June in both years, followed by a decline in prevalence to about 10% in December/February. The mid year levels in the second year show a higher peak prevalence in June and a longer period of high prevalence from April till October. However, the improvement between October and December 1992 was considerable, and prevalence of wasting reached the lowest level recorded in Morrelganj in December 1992.

MUAC showed a trend to worsening prevalence over the 2 years. Seasonality was more apparent in the second year, rising to a peak high level of about 15% in October 1992. In 1991, there was a drop in prevalence in August/October, showing the same pattern as wasting. The improvement in MUAC and wasting at this time was seen in many parts of Bangladesh with many thanas showing uncharacteristic improvement in mid 1991. The recovery of MUAC after

October 1992 is not so complete as the improvement in wasting at this time. However both indicators show a big improvement between October and December 1992, coinciding with the effects of the good harvest in 1992, and a lower prevalence of diarrhea in the nutritional surveillance sample in December/February 1993.



### Stunting & Underweight

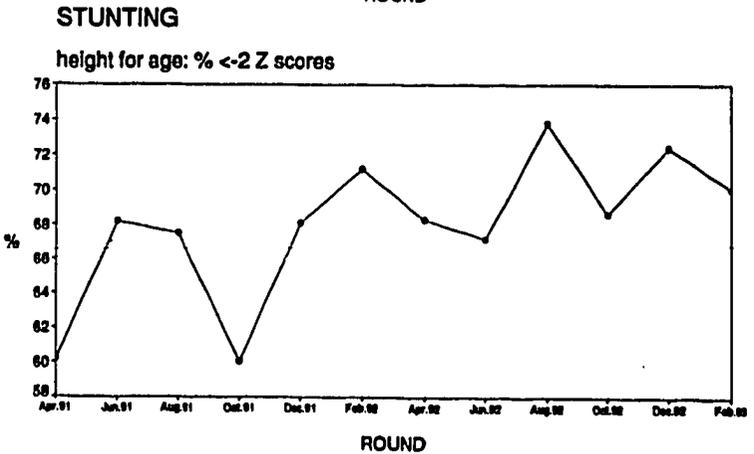
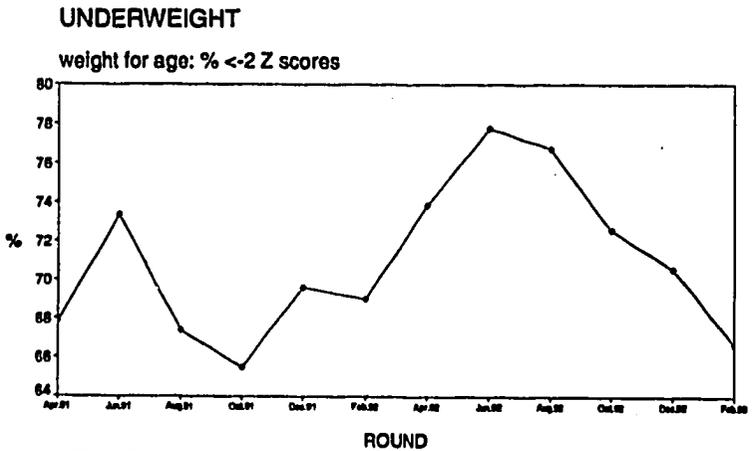
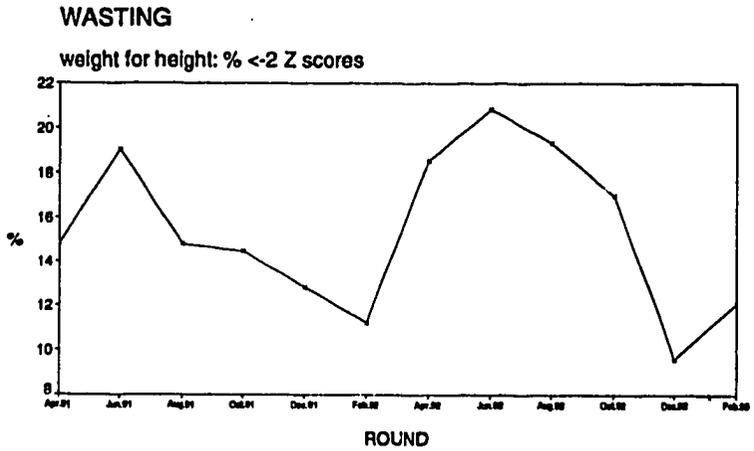
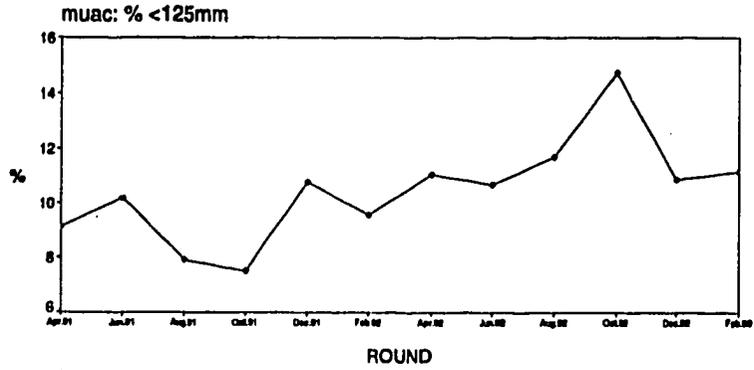
Stunting showed a trend to worsening over the 2 years rising from a prevalence of about 60% up to 70% prevalence. There was the suggestion of seasonality with high August levels followed by a decrease in prevalence in October, and a rise in December.

Underweight basically showed a similar seasonal pattern to wasting. There was a probably uncharacteristically large improvement in August of 1991 and a higher peak level in June 1992.

*Average prevalence of undernutrition (%)  
(for definition of the indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 9.3                                 | 11.6                                | -                                |
| Wasting             | -                                   | 14.4                                | 16.0                                | -                                |
| Underweight         | -                                   | 68.9                                | 72.9                                | -                                |
| Stunting            | -                                   | 66.1                                | 70.1                                | -                                |

**MORELGANJ: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE**



## MIRZAGANJ (Data Collected by IPIIN)

Data was collected for two years. Wasting showed cyclical seasonality but no longer term trend. Stunting showed evidence of decreasing over the 2 years and also showed cyclical seasonality.

### *MUAC & Wasting*

Wasting had a lower prevalence of about 8% in December/February of both years. In June 1992 there was an increase to about 20% but this rise was not apparent in 1991.

MUAC showed the same pattern as wasting in Mirzaganj and seasonal swings ranged from 8% to 15%. Although only 2 years data are available, this pattern is consistent with other thanas which showed a less than expected rise in undernutrition in mid 1991.

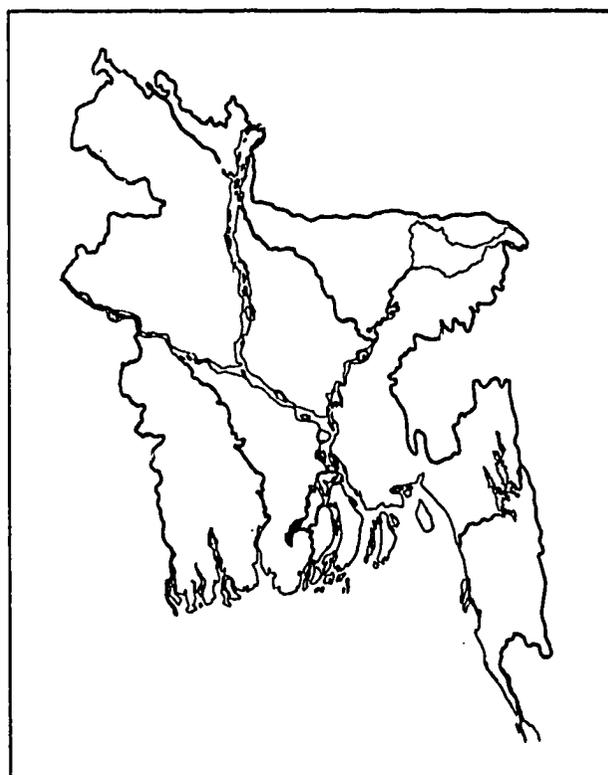
### *Stunting & Underweight*

Stunting decreased over the 2 year period and showed definite seasonality, with more stunted children in August and less in April/June and December. The seasonal swings of stunting occur some months after the seasonal swings of wasting showing a slower response of stunting to changed nutrition, compared with wasting. A steep increase in stunting occurs between June and August in both years, probably reflecting the earlier rise in wasting after February. The rise in stunting between December and February was probably due to the rise of wasting between August and October.

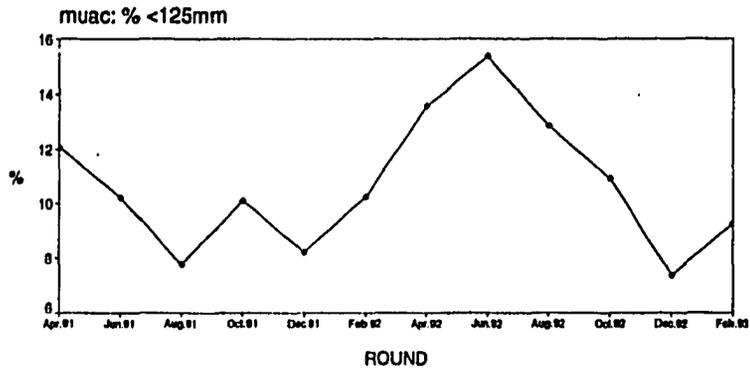
Underweight showed the same seasonal pattern as wasting and MUAC. There was a seasonal peak level in June-October of over 70%, and a seasonal low in December/February of about 60%.

*Average prevalence of undernutrition (%)  
(for definitions of indicators, see graphs)*

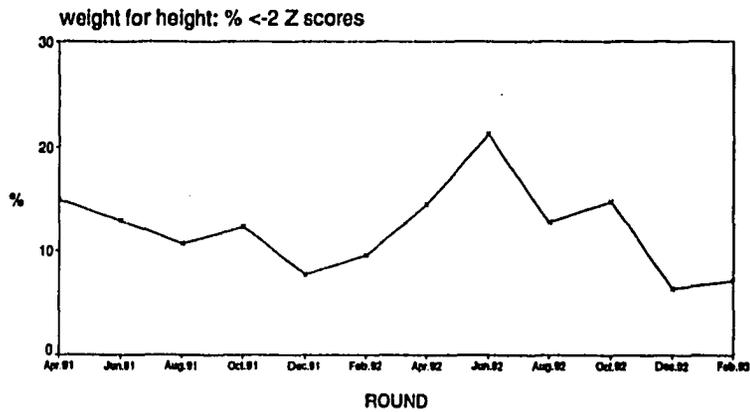
| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 9.9                                 | 11.2                                | -                                |
| Wasting             | -                                   | 11.5                                | 12.1                                | -                                |
| Underweight         | -                                   | 70.7                                | 68.5                                | -                                |
| Stunting            | -                                   | 71.2                                | 69.7                                | -                                |



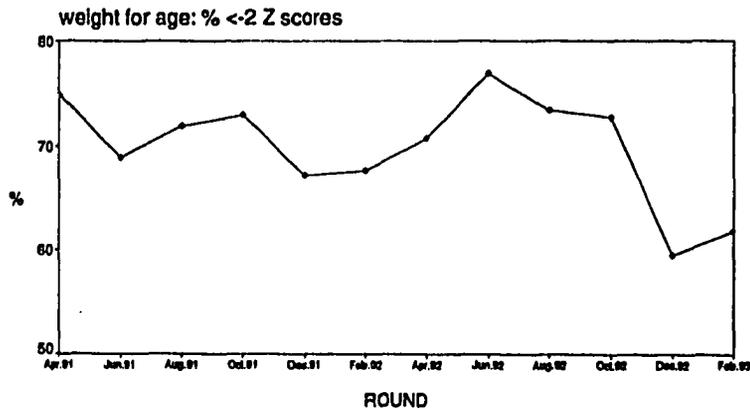
MIRZAGANJ: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



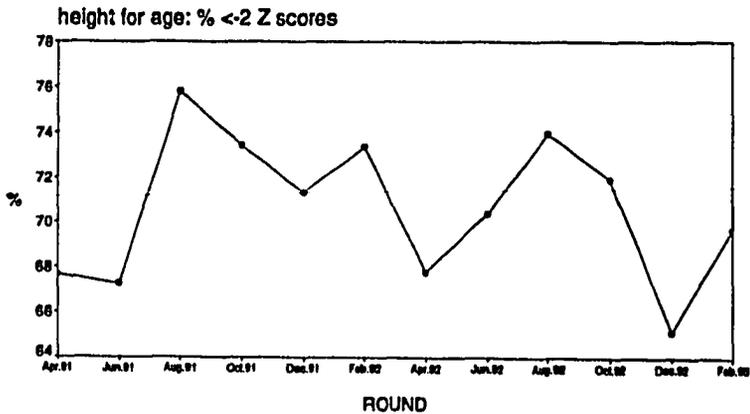
WASTING



UNDERWEIGHT



STUNTING



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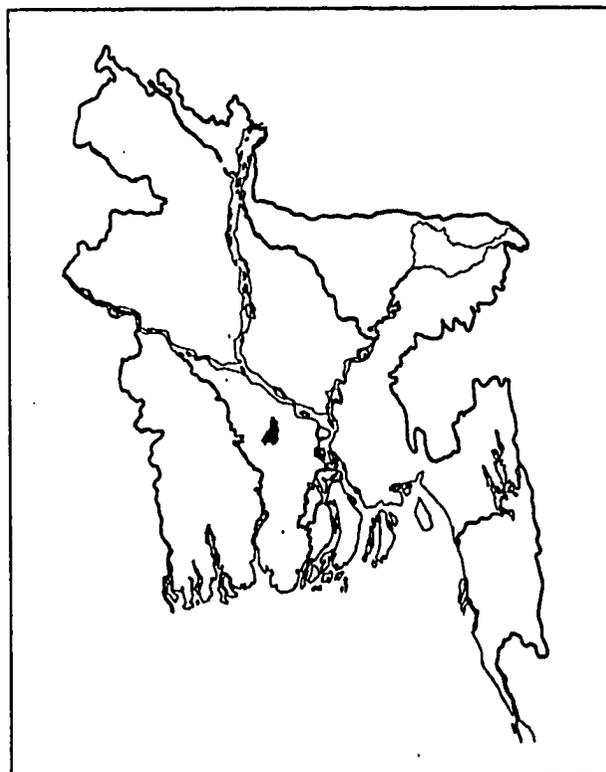
**RAJOIR** (Data Collected by GUP)

There was marked seasonality of wasting and a worsening trend. Stunting also showed cyclical seasonal changes in the second and third years. There was a longer term trend to increasing stunting.

*MUAC & Wasting*

Wasting ranged from a lower level of 5-10% in February each year, up to about 20% in June to October. The seasonal lower levels of wasting in February coincided with the post Aman harvest, generally lower market prices and lower levels of diarrhoea. In Rajoir, the peak in August 1991 is higher than in the other years, a pattern not seen in many NSP areas which showed a lower level in mid 1991. Another difference is the relatively higher February level in 1993, when most thanas showed a better level compared with the previous two years.

MUAC shows a trend to worsening, the yearly averages increasing each year and both high and low seasonal levels increasing over the period. The lower February level in 1991 was about 9%, but in 1993 this had increased to about 15%. In the first two years the October level of undernutrition by MUAC was relatively low, but was high in the third year despite a good harvest in 1992.



*Stunting & Underweight*

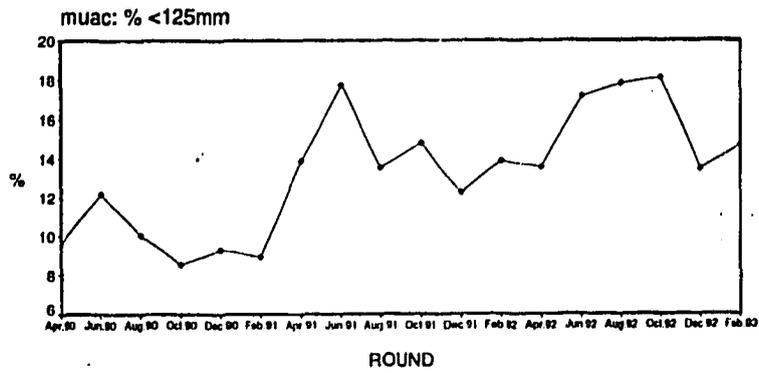
Although cyclical seasonal changes in the prevalence of stunting was not so apparent in the first year, seasonality was seen in the second and third years. Lower mid year levels around 70% or less swung to high levels around 80% in October and remained high till February. The cyclical swings in stunting occurred about 4-6 months after the corresponding changes in wasting, reflecting the more delayed response of stunting to nutritional deprivation. There was a trend to increasing stunting in the 2nd year. In 1992 there was a very large drop in stunting between February and April, reversing the apparent rising trend of prevalence in the preceding months.

Underweight showed a trend to worsening, although this indicator suggests some recovery in February 1993, unlike the pattern shown by wasting. Underweight was also seasonal showing the usual better months in December/February, and the worse mid year period.

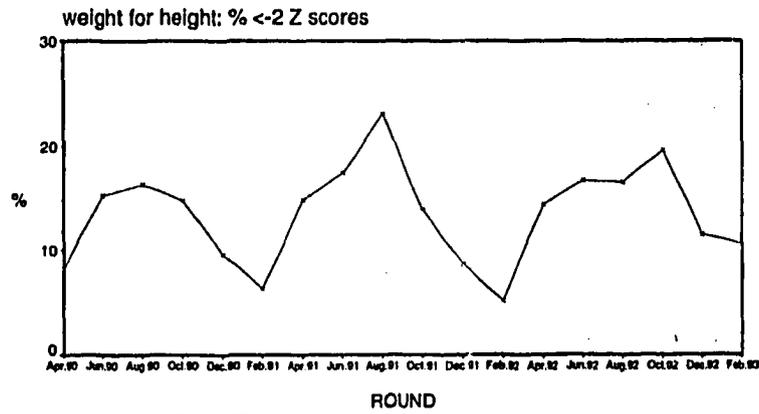
*Average prevalence of undernutrition (%)*  
(for definition of indicators, see graphs)

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 9.7                                 | 14.3                                | 15.7                                | 13.3                             |
| Wasting             | 11.9                                | 13.5                                | 14.7                                | 13.4                             |
| Underweight         | 69.6                                | 73.0                                | 72.7                                | 71.7                             |
| Stunting            | 69.1                                | 74.7                                | 72.8                                | 72.1                             |

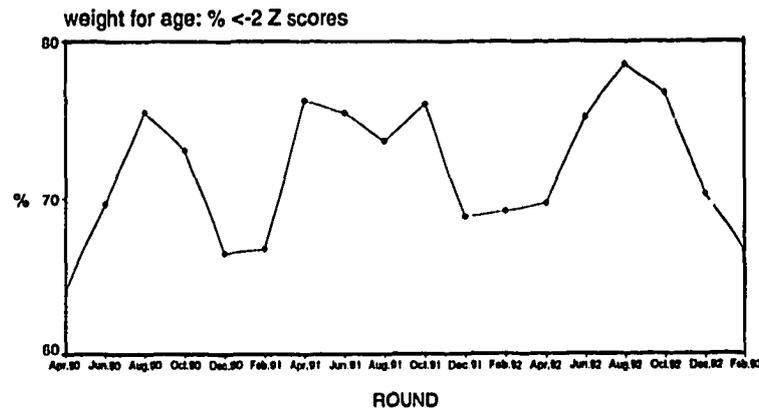
RAJOIR: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



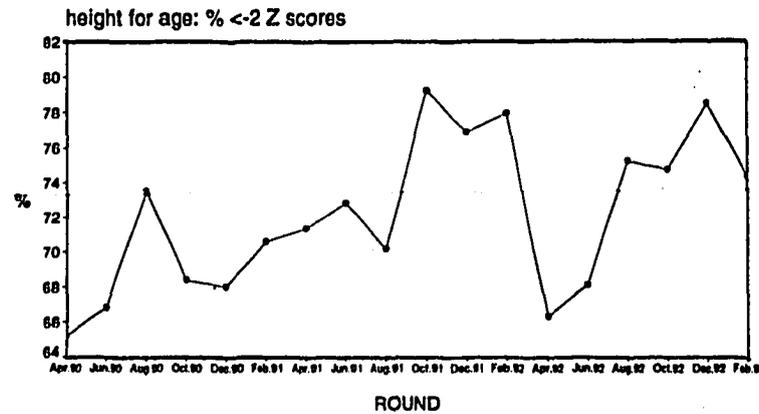
WASTING



UNDERWEIGHT



STUNTING



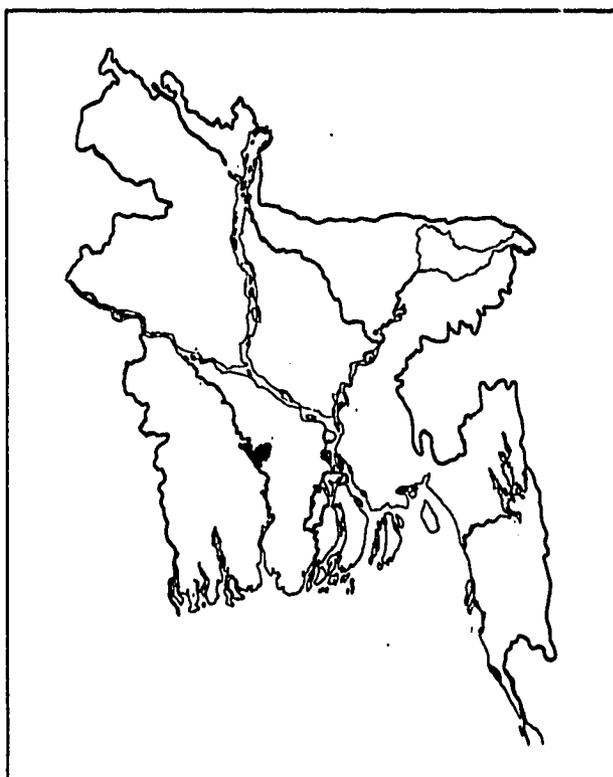
## GOPALGANJ (Data Collected by GUP)

Gopalganj showed marked cyclical seasonality of wasting and also showed seasonality of stunting. There was a trend to slightly increasing stunting over the 3 year period and slightly decreasing wasting.

### *MUAC & Wasting*

The patterns shown by these two indicators were basically similar, although the seasonal changes are easier to see by prevalence of wasting which ranged from about 6% in December/February following the Aman harvest, to 15% in June/August in the mid-year lean times. A fairly stable situation in June/August probably reflects food availability from the mid year boro harvest.

MUAC differed from wasting in October and December 1991, where high levels of undernutrition by MUAC did not correspond with the decreasing levels of wasting. While there is some considerable overlap between these 2 indicators, they measure different aspects of nutritional status and do not always follow the same pattern. There was a trend to slightly decreasing prevalence of wasting. The prevalence of MUAC increased over the 3 years.



### *Stunting & Underweight*

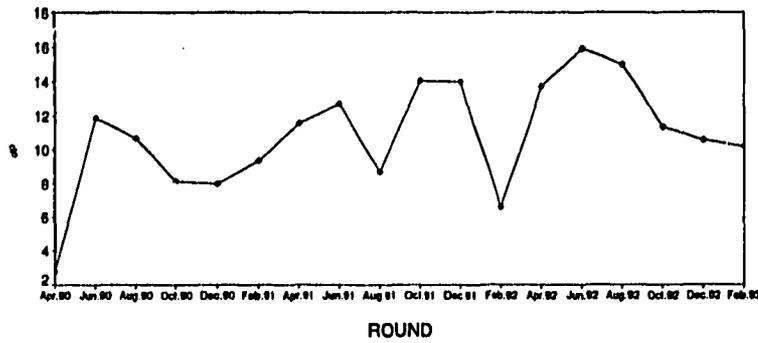
Stunting was at highest levels around December, and lowest levels around April. This type of seasonal pattern was seen in other nutritional surveillance areas. Stunting showed a delayed response to poor nutrition with the prevalence of stunting peaking 4 to 6 months after the peak prevalence of wasting in the middle of the year. Stunting prevalence ranged from low values around 65% in April to around 75% in October. Underweight also showed cyclical seasonality in 1991 and 1992, although 1990 showed an uncharacteristic high peak in December, reflecting the sharp rise in stunting at the same time.

### *Average prevalence of undernutrition (%)* *(For definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | 8.9                                 | 11.3                                | 12.8                                | 11.0                             |
| Wasting             | 12.6                                | 12.0                                | 12.2                                | 12.3                             |
| Underweight         | 67.2                                | 66.5                                | 68.4                                | 67.4                             |
| Stunting            | 67.4                                | 69.8                                | 71.0                                | 69.4                             |

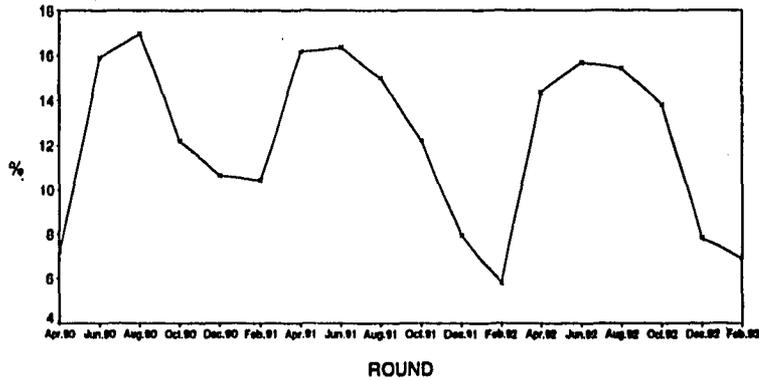
**GOPALGANJ: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE**

muac: % <125mm



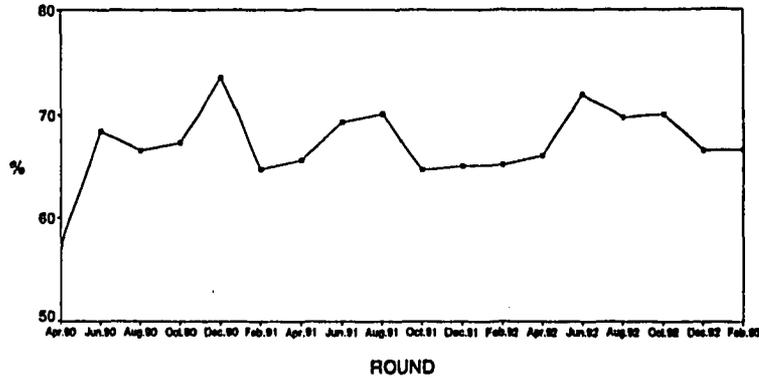
**WASTING**

weight for height: % <-2 Z scores



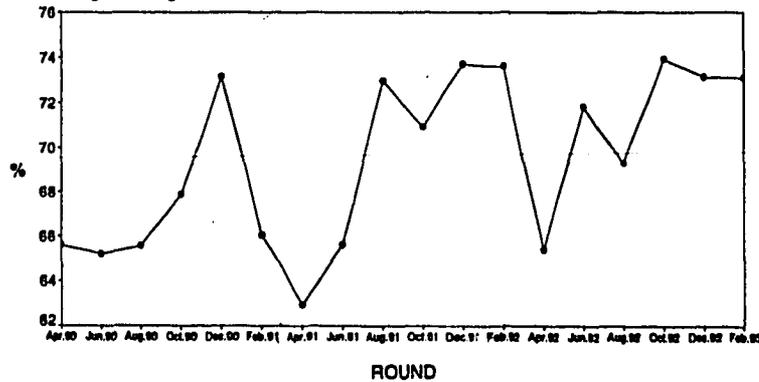
**UNDERWEIGHT**

weight for age: % <-2 Z scores



**STUNTING**

height for age: % <-2 Z scores



**MATLAB MCH-FP (Data Collected by ICDDR,B)**

*This area is in Matlab Thana and is covered by the ICDDR'B Maternal and Child Health-Family Planning Intervention Program.*

Data collection began in June 1990. Wasting showed marked cyclical seasonality and a trend suggesting improvement in wasting. Stunting also showed seasonality and there was an overall trend to worsening stunting over the 3 year period.

*MUAC & Wasting*

MUAC did not show the expected rise in prevalence of undernutrition in June/August 1991, but seasonality is present in the other years. Wasting showed consistent seasonality each year, with a high 25% prevalence in June/August falling to a lower 10% in December/February. The period June to February is characterized by a slowly improving situation, possibly reflecting the influence of the boro mid year harvest in this region.

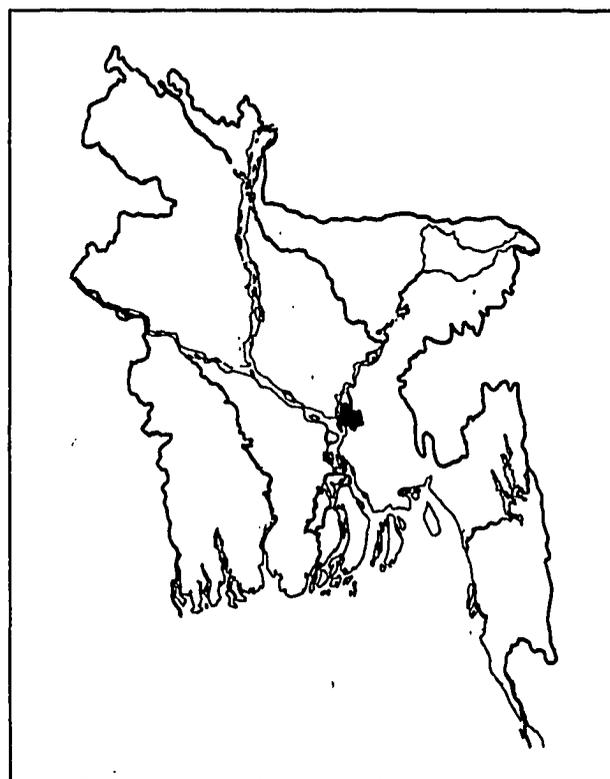
*Stunting & Underweight*

Underweight also showed seasonality each year and followed the same pattern as wasting. The lower prevalence of underweight in February was about 65%, rising to 75% in June.

Stunting showed an overall trend to increasing prevalence up to the end of 1991, with a seasonal cycle of lower prevalence in February to June. There is a sharp rise in stunting between June and August in the first 2 years and between August and October in 1992. This is 4 to 6 months after the sharp rise in wasting between February and April each year, as stunting responds more slowly than wasting to a changed situation in nutrition.

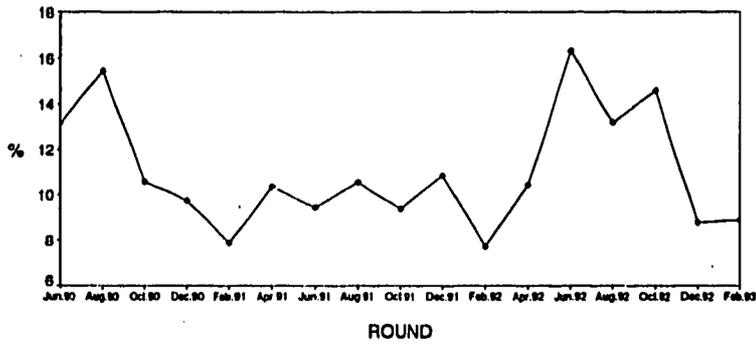
*Average prevalence of undernutrition (%)  
(for definitions of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 9.7                                 | 11.9                                | -                                |
| Wasting             | -                                   | 17.7                                | 16.7                                | -                                |
| Underweight         | -                                   | 72.1                                | 73.1                                | -                                |
| Stunting            | -                                   | 70.0                                | 70.4                                | -                                |



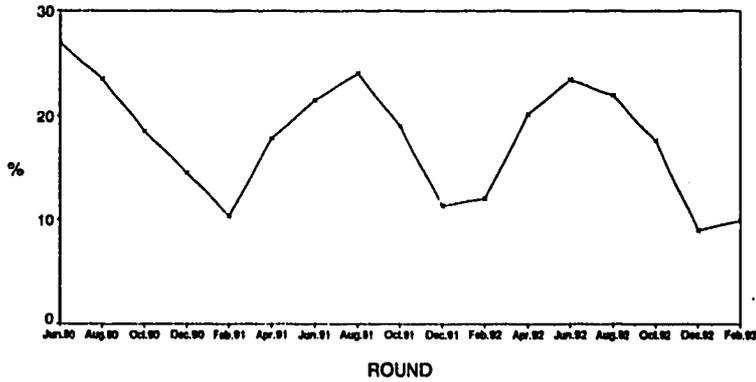
**MATLAB MCH-FP: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE**

muac: % <125mm



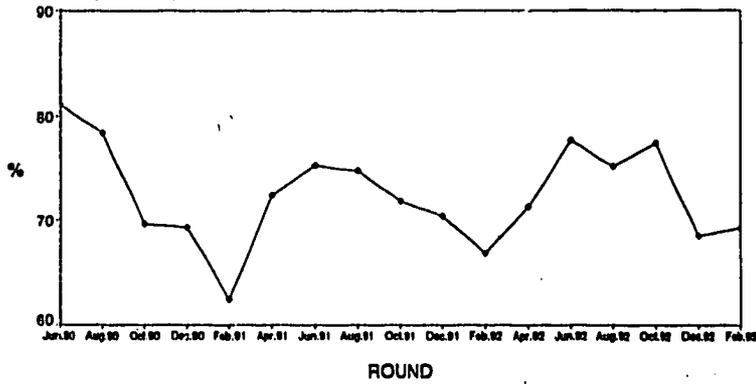
**WASTING**

weight for height: % <-2 Z scores



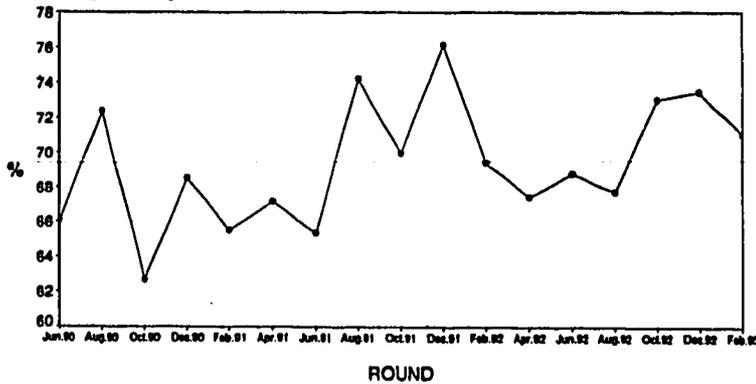
**UNDERWEIGHT**

weight for age: % <-2 Z scores



**STUNTING**

height for age: % <-2 Z scores



## MATLAB EXTENSION (Data Collected by ICDDR,B)

*This area lies within Matlab and Daudkandi thanas. It is outside the ICDDR'B Maternal and Child Health - Family Planning intervention area.*

Data collection began in June 1990. Wasting showed pronounced seasonal changes and a trend to slight improvement. Stunting did not show consistent seasonal patterns and there was no longer term trend.

### *MUAC & Wasting*

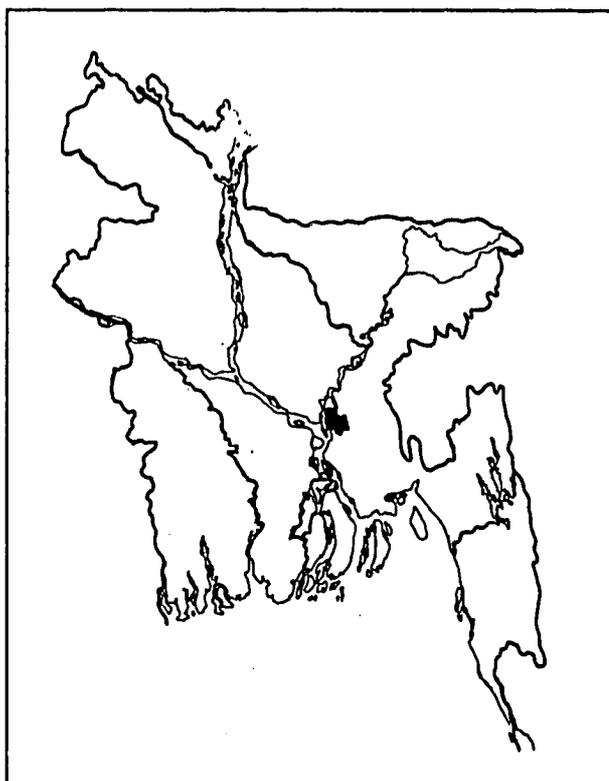
Wasting varied from lowest prevalence in December/February of about 10% to highest levels around 20% in June to October. These seasonal patterns were very consistent over the 3 years. MUAC showed similar seasonality in the first and third years, but did not show the expected June rise in prevalence in 1991. In all 3 years improvement was apparent between April/June and June/August, which may have been due to the boro mid year harvest.

### *Stunting & Underweight*

Seasonal patterns of stunting were not clear, with lowest levels of stunting in August of the first and third years around 70% , but a high level in August of 1991. There was no overall trend to worsening or improving stunting over the 3 years. Underweight showed a pattern similar to wasting, with best times in December/February and higher levels of underweight from April to October.

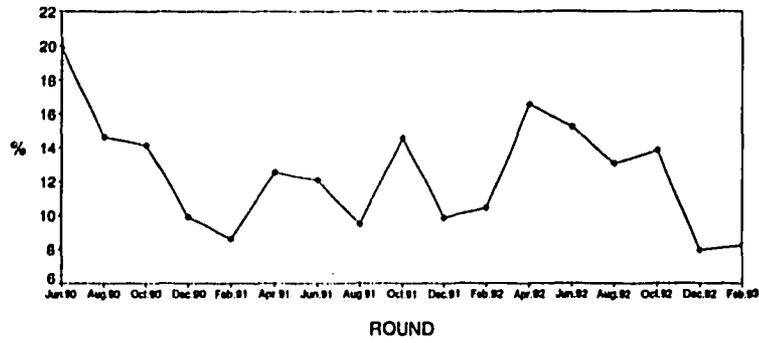
*Average prevalence of undernutrition (%)  
(for definition of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | 11.5                                | 12.3                                | -                                |
| Wasting             | -                                   | 15.7                                | 15.0                                | -                                |
| Underweight         | -                                   | 75.2                                | 75.0                                | -                                |
| Stunting            | -                                   | 75.6                                | 74.3                                | -                                |



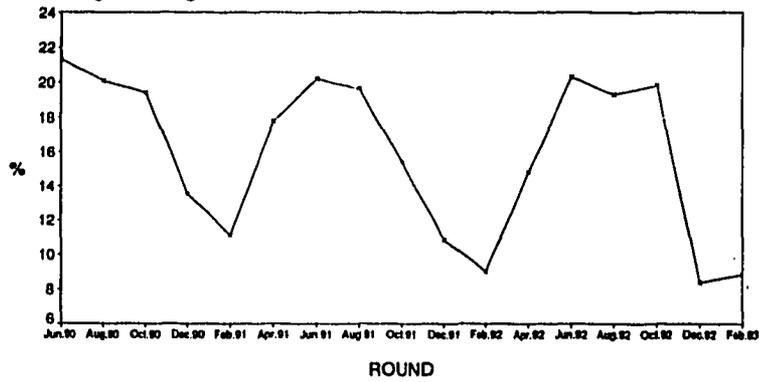
MATLAB EXT.: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE

muac: % <125mm



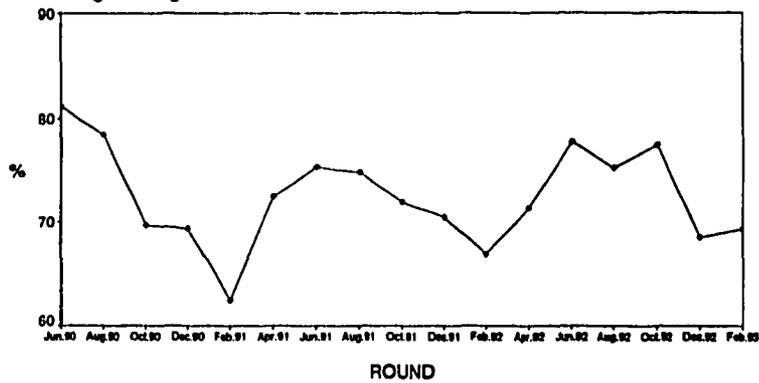
WASTING

weight for height: % <-2 Z scores



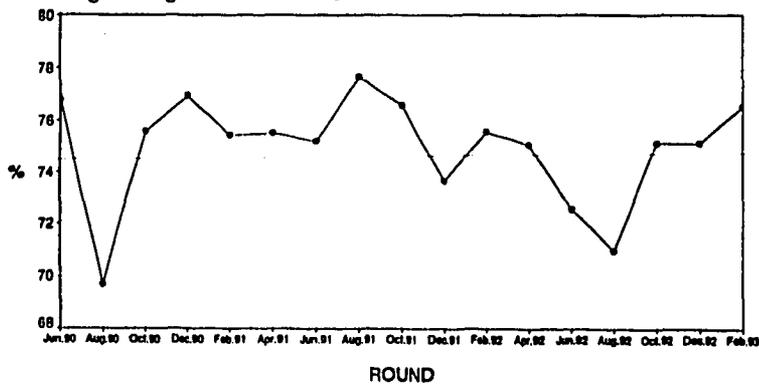
UNDERWEIGHT

weight for age: % <-2 Z scores



STUNTING

height for age: % <-2 Z scores



## MOHESHKHALI (Data Collected by BDRCS)

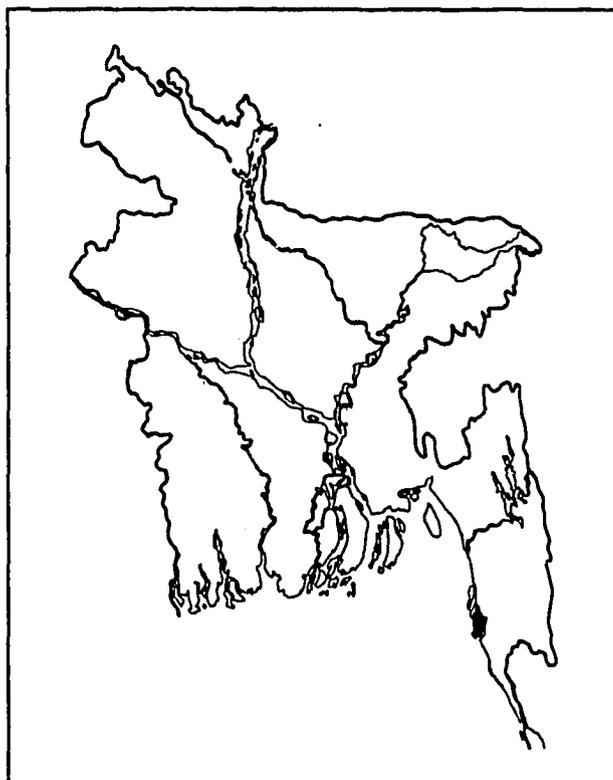
It was not possible to determine any cyclical seasonal patterns over only one year. Although there was an overall decrease in the level of wasting over the one year, it is not possible to say whether this is mostly due to seasonality or to longer term trends. Stunting is highest in December, and seems to show an inverse pattern to wasting.

### *MUAC & Wasting*

Wasting began at a very high level around 35% in April 1992, and continued to fall to around 5% in February 1993. There was a small rise in October. MUAC prevalence showed a drop between June and August, 2 months after a corresponding drop in wasting levels. However, the rise in undernutrition by MUAC in February 1993 does not mirror wasting and is unexpected when compared with the usual pattern of improvement in February in other areas.

### *Stunting & Underweight*

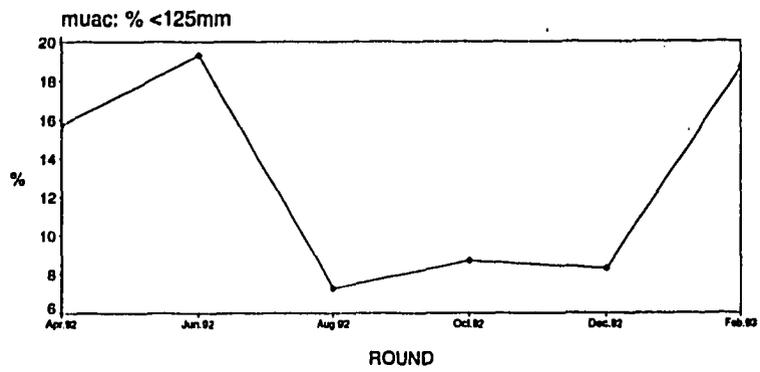
Stunting rose from comparatively lower levels for Bangladesh of around 58% in April 1992 to nearly 80% in December. Some areas have shown a seasonal pattern of higher prevalence of stunting at this time, but it is too soon to draw conclusions about Moheshkhali. Underweight showed a decreasing prevalence during the one year, reflecting the falling prevalence of wasting. The large drop in the level of underweight between December and February reflects the drop in the level of stunting at this time.



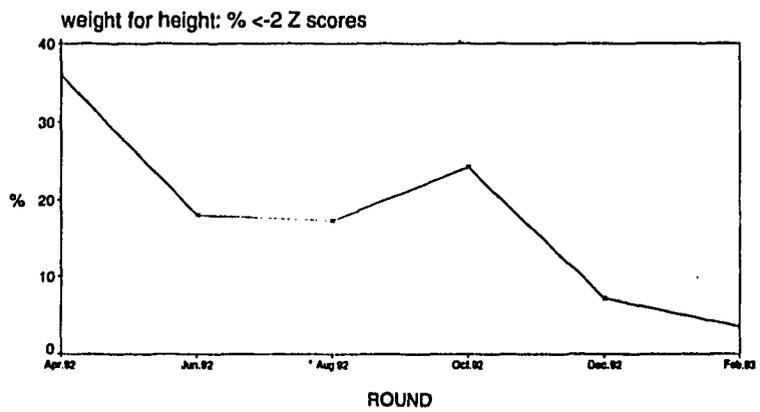
*Average prevalence of undernutrition (%)  
(for definitions of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                  | -                                   | 12.7                                | -                                |
| Wasting             | -                                  | -                                   | 16.2                                | -                                |
| Underweight         | -                                  | -                                   | 68.5                                | -                                |
| Stunting            | -                                  | -                                   | 65.0                                | -                                |

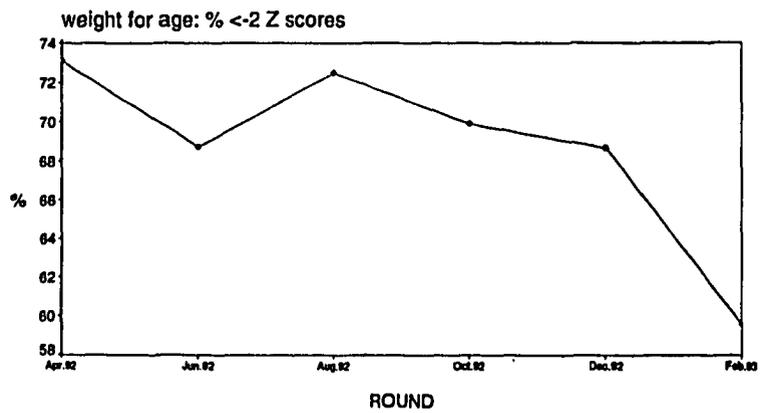
MOHESHKHALI: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE



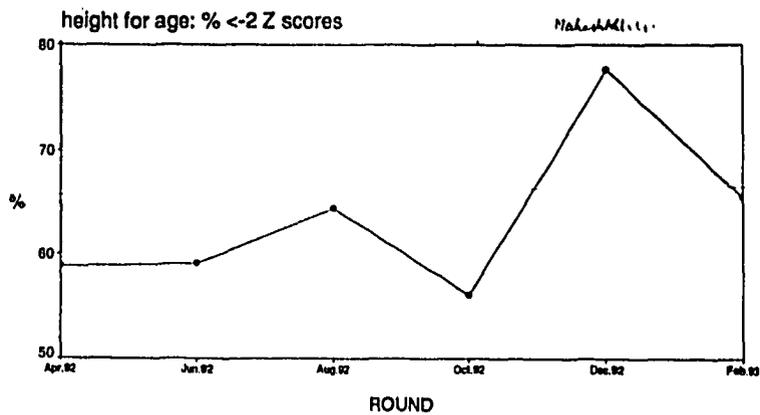
WASTING



UNDERWEIGHT



STUNTING



**TEKNAF (Data Collected by BDRCS)**

It was not possible to determine any cyclical seasonality over a one year period. Wasting showed a trend towards improvement during this time, while stunting showed a trend to worsening.

**MUAC & Wasting**

Wasting dropped from a high prevalence around 25% in April 1992, to about 8% in February 1993. There was an increase in October, followed by a drop to December/February, a pattern seen commonly in the other thanas.

MUAC dropped from a high 20% in April 1992 to a low level around 4% by August, and remained at this low level without seasonal change for the rest of the year. It will only be possible to see if a seasonal pattern will become apparent after a longer time period of data collection.

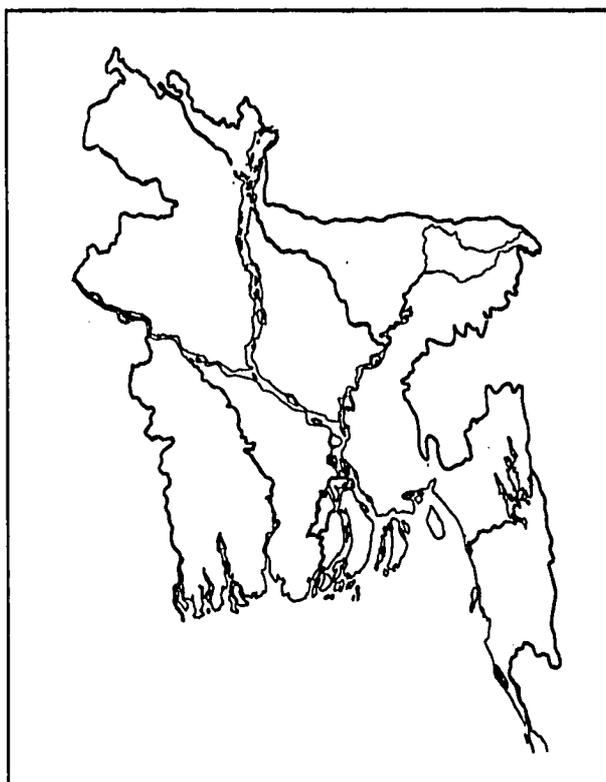
**Stunting & Underweight**

Stunting rose from about 60% to 75% over the one year, a considerable increase. The prevalence see-sawed during the year, and as yet it is not possible to determine if there is a seasonal pattern.

Underweight was most notable for the large drop in prevalence in August 1992 from approximately 70% to 60%, and then a rapid rise to a similar high level next round of data collection. This reflects the drop in the prevalence of stunting by about 10% in August also. The patterns shown by stunting and underweight are similar.

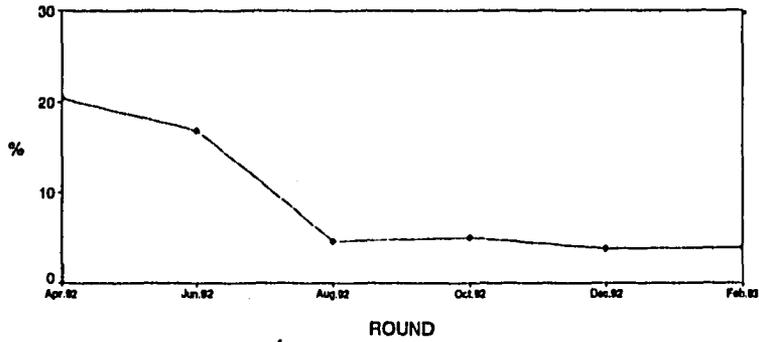
*Average prevalence of undernutrition (%)  
(for definitions of indicators, see graphs)*

| Nutrition indicator | 1st Year<br>(Apr 1990<br>-Feb 1991) | 2nd Year<br>(Apr 1991<br>-Feb 1992) | 3rd Year<br>(Apr 1992<br>-Feb 1993) | Total<br>(Apr 1990<br>-Feb 1993) |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|
| MUAC                | -                                   | -                                   | 7.7                                 | -                                |
| Wasting             | -                                   | -                                   | 15.3                                | -                                |
| Underweight         | -                                   | -                                   | 68.8                                | -                                |
| Stunting            | -                                   | -                                   | 67.6                                | -                                |



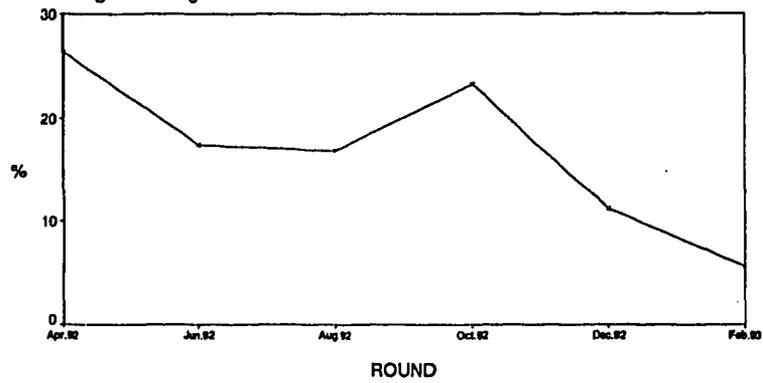
TEKNAF: children 6-59 months  
MID UPPER ARM CIRCUMFERENCE

muac: % <125mm



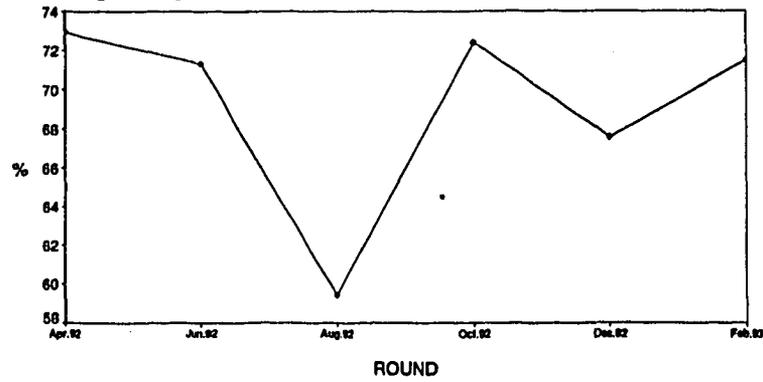
WASTING

weight for height: % <-2 Z scores



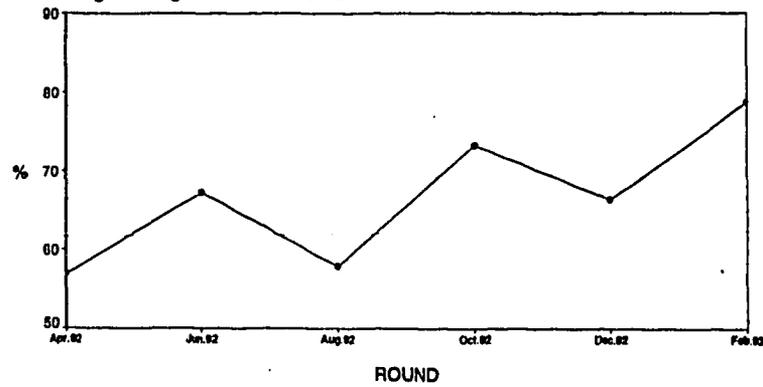
UNDERWEIGHT

weight for age: % <-2 Z scores



STUNTING

height for age: % <-2 Z scores



### Relative prevalence of wasting and stunting in each thana

The average prevalence of the one year period April 1992 - February 1993 provides a comparison that does not depend on seasonal considerations. Wasting is a measure of more recent change in nutrition, while stunting reflects longer term change in nutrition.

The interdependence between wasting and stunting can be seen in some thanas, which have an inverse pattern. The very highest level of wasting of over 20% is in Shakhipur, which also has the lowest level of stunting. Stunting is based on "height for age" and wasting is "weight for height"; it can be seen that changes in height will affect both indicators. If height is proportionately less than weight then paradoxically wasting will be better. Former ideas about beneficial adaptation of the body through stunting leading to less wasting, are now being questioned. The idea of "small but healthy" does not appear substantiated, as low height for age is quite a good predictor of the risk of dying. In a disaster situation, wasting is probably the more useful indicator as it shows recent undernutrition. However, at other times, the significance of stunting should not be overlooked.

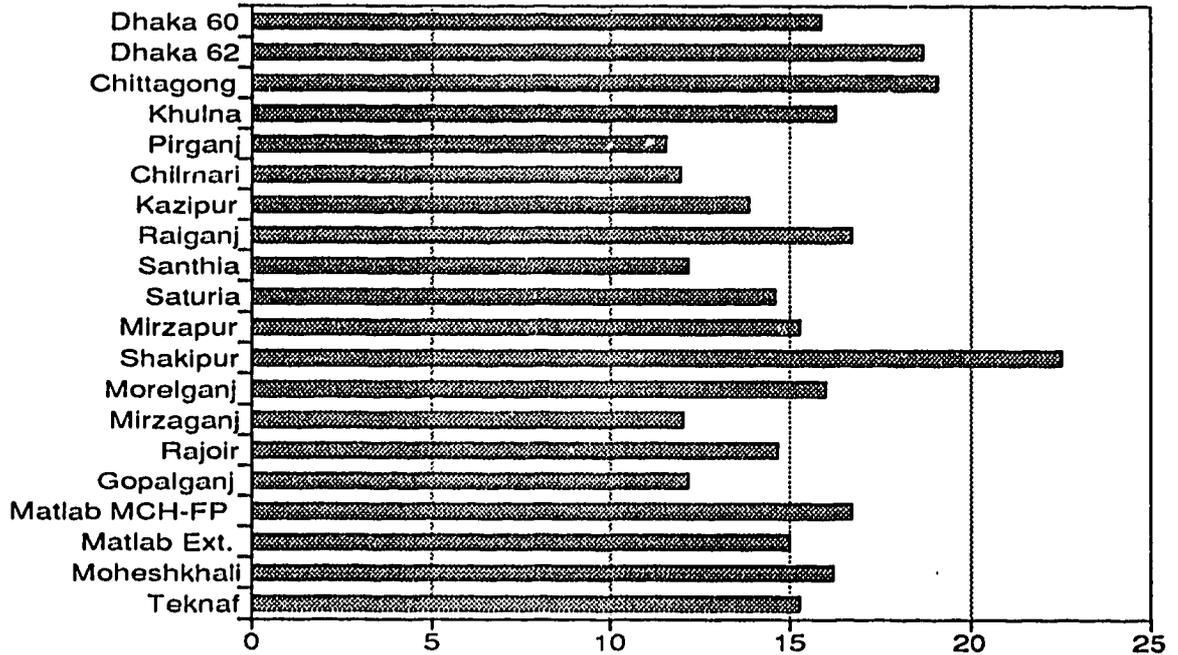
Another relationship between wasting and stunting is the timing of seasonal change, stunting often following changes in the prevalence of wasting by a few months. It is likely that both indicators are responding to the same change in nutritional balance but that wasting responds more rapidly than stunting.

The levels of wasting are generally high, with 12 of the 20 sentinel points having an average prevalence over 15%, a level which is sometimes regarded as "critical". Stunting is also high, the lowest levels still being over 55%. In general, the urban slums had worse levels of undernutrition than most of the rural thanas.

**Comparison of Wasting and Stunting in each thana.  
Mean prevalence April 1992 - February 1993**

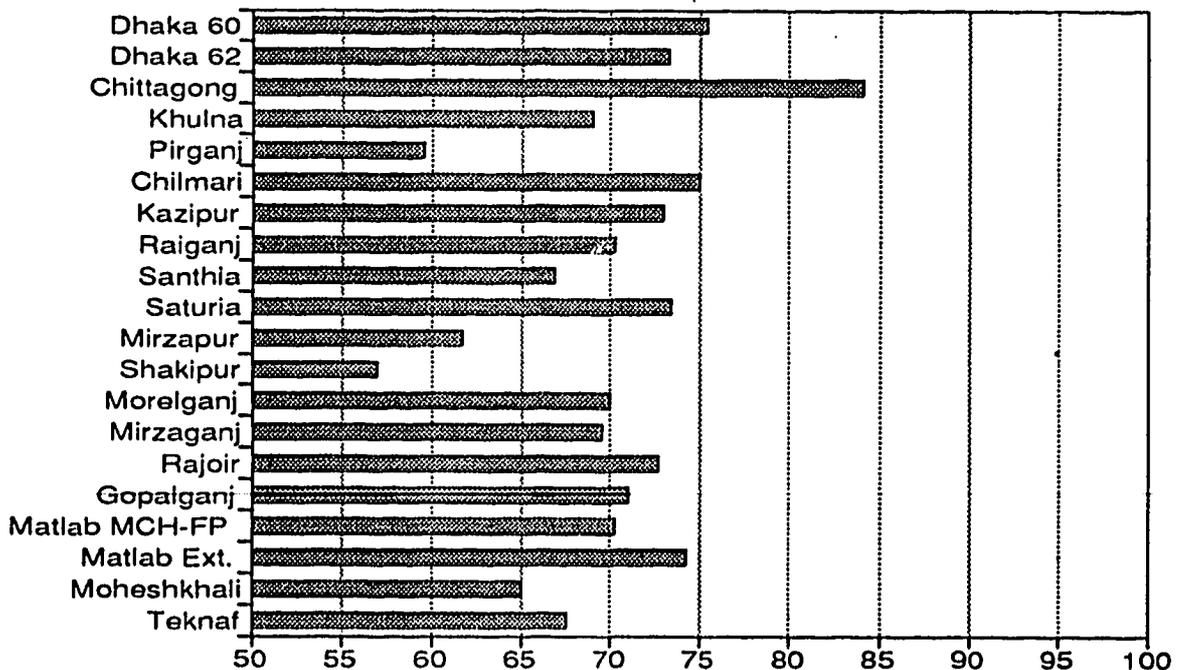
**WASTING**

Weight for Height: % <-2Z Scores



**STUNTING**

Height for Age: % <-2Z Scores



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