LACK OF IMPACT OF A WATER AND SANITATION INTERVENTION ON THE NUTRITIONAL STATUS OF CHILDREN IN RURAL BANGLADESH

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The nutritional impact of a water and sanitation intervention in a rural community of Bangladesh, comprising the provision of handpumps, construction of latrines and hygiene education was assessed. During 3 years, the quarterly anthropometric measures of about 200 children aged 12-35 months from the intervention community were compared with those of a similar number of children from a control area. The interventions reduced the incidence of diarrhoea by 25 per cent among the children less than 5 years of age. There was no significant difference in nutritional status, however, between the two groups of children. Moreover, within the intervention area, indicators of water and latrine use were not significantly related to the children's nutritional status. This suggests that either the obtained reduction of diarrhoea was not large enough to have an impact on nutritional status or that diarrhoea is not an important cause of malnutrition in this community.

Efforts to quantify the health improvements obtained from water and sanitation interventions have often led to conflicting results. Differences may be partly attributable to the difficulty of defining the incidence, prevalence and severity of diarrhoea in the field. To overcome this difficulty, the use of nutritional anthropometry has been advocated to assess the health impact of water and sanitation interventions (Chen, 1983; Esrey & Habicht, 1986; The Imo State Evaluation Team, 1989). Also, because anthropometric measures are well standardized and comparatively easy to obtain, they may be better indicators of the impact of hygiene interventions than information on diarrhoea.

In this study, nutritional data from a water and sanitation intervention from rural Bangladesh, which achieved a significant reduction in diarrhoea incidence, are analysed to assess the validity of this integrated approach.

Materials and methods
A Handpump Project (Aziz et al., 1989) took place in a rural area of Bangladesh, near the town of Mirzapur, about 60 km north of Dhaka. In this area, 77 per cent of the families were Muslim and 49 per cent of adult males and 78 per cent of adult females were illiterate. Most men were engaged in agricultural activity or daily waged labour, while women worked mainly in the home. Rainfall is seasonal, occurring mostly in the period of June to October. Maximum temperatures range between 25°C and 35°C.
To evaluate the impact of this project, two areas separated by a distance of about 5 km were studied: an intervention area of two villages with approximately 5000 inhabitants and a control area of three villages with a population of about 4600 inhabitants. The intervention and control areas were selected carefully keeping in view their similar socio-economic characteristics. Both the areas were at an almost equal distance from a hospital and no major epidemic of any disease occurred in either of these areas during the study period. Handpumps, latrines and hygiene education were provided only to the intervention area. Oral rehydration therapy for children suffering from diarrhoea was secured to a solid wooden base and equipped with a flat movable arm.

Analysis of the impact of the project on nutritional status was restricted to children aged 12-35 months. This age group was chosen since the impact of diarrhoea on growth is pronounced among them (Rowland, Cole & Whitehead, 1977) and it was believed that their anthropometric indicators would be most sensitive to the effect of intervention. Anthropometric measures were referred to the NCHS standards (Hamill et al., 1986). Nutritional indices for weight-for-age (W/A), height-for-age (H/A), and weight-for-height (W/H), were calculated in Z-scores, representing the difference of an anthropometric measure from the NCHS reference expressed in standard deviation units (WHO Working Group, 1986).

Nutritional differences between the intervention and control areas were measured by comparing mean Z-scores. Due to the heterogeneous user pattern of the improved facilities within the intervention area, comparisons of nutritional status were also made between subgroups in this area. For these latter comparisons, the average nutritional status for each child for 1986 and 1987 was computed. T-test or one-way analysis of variance, whenever appropriate, were used to compare means (Armitage, 1971).

Results

On average, for each anthropometric survey, complete data were available for 215 and 192 children aged 12-35 months in the intervention and control areas respectively. The mean age of children studied in each area was 23 months.

The intervention had a considerable impact on diarrhoea in children under 5 (Aziz et al., 1989). Baseline diarrhoea incidence rates (1984) were similar in the intervention and control area (3.85 and 3.75 episodes per year per child respectively). These steadily declined to 2.34 and 3.12, respectively in 1987 (incidence density ratio: 0.75, 95 per cent CI: 0.70-0.80). This impact was evident in all seasons and in all age groups, except those aged less than 6 months of age. The reduction in the age group (12-35 months) studied here was slightly more than 25 per cent (Aziz et al., 1989).

The variations in nutritional indicators throughout the study period are presented in Figs 1 to 3 by area. The mean W/A Z-scores ranged between -2.4 and -1.6, and were similar in the two areas.

Within the study area, none of the nutritional indicators showed a significant association with the distance from the handpump (Table). However, disposal of

![Fig. 1. Variations of weight-for-age during the study.](image-url)
Water and sanitation intervention in Bangladesh

Fig. 2. Variations of weight-for-height during the study.

Fig. 3. Variations of height-for-age during the study.

Discussion

Although the incidence of diarrhoea in the intervention area after the water and sanitation interventions was 25 per cent lower than in the comparison area, there is no evidence that this was associated with an improvement in nutritional status. This can be explained in different ways. First, an overestimation of the impact of the project on diarrhoea incidence has to be considered. Project staff and the community under investigation knew that the aim of the study was to decrease the diarrhoea incidence and an under-reporting of diarrhoea episodes in the intervention area cannot be ruled out. Hence it is possible that the actual impact of the intervention on diarrhoea incidence was smaller than reported here and not large enough to affect the nutritional status of children. Investigators, however, were aware of this possibility and made all efforts during training and supervision to ensure that such a bias would not occur. Moreover, the magnitude of the difference of diarrhoea incidence between the two areas and its consistency over time make this explanation unlikely.

Another interpretation of the present finding is that diarrhoea is not the major determinant of nutritional status in rural Bangladesh. This hypothesis is supported by the pattern of seasonal variation of nutritional status and diarrhoea: malnutrition is most prevalent in September and October when food availability is at its lowest and also when diarrhoea incidence is low. On the other hand, malnutrition is at its lowest level during the annual peaks of diarrhoea between March and May (Aziz et al., 1989). Similar seasonal variations of diarrhoea incidence and prevalence of malnutrition were reported in previous studies from a similar community (Black et al., 1983; Brown, Black & Becker, 1982). Food availability, and not

Table. Nutritional status (by Z-score) in relation to water and hygiene indicators for children from the intervention area.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>1986</th>
<th>1987</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W/A</td>
<td>H/A</td>
</tr>
<tr>
<td>Handpump-distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25m</td>
<td>-2.62</td>
<td>-2.59</td>
</tr>
<tr>
<td>25-49m</td>
<td>-2.56</td>
<td>-2.57</td>
</tr>
<tr>
<td>50+ m</td>
<td>-2.57</td>
<td>-2.57</td>
</tr>
<tr>
<td>P-value*</td>
<td>0.9</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>Defaecation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>children/</td>
<td>disposal of faeces in latrine</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-2.43</td>
<td>-2.50</td>
</tr>
<tr>
<td>No</td>
<td>-2.62</td>
<td>-2.57</td>
</tr>
<tr>
<td>P-value</td>
<td>0.05</td>
<td>0.6</td>
</tr>
<tr>
<td>Use of handpump water for all major domestic activities in the wet season</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-2.43</td>
<td>-2.50</td>
</tr>
<tr>
<td>No</td>
<td>-2.48</td>
<td>-2.51</td>
</tr>
<tr>
<td>P-value</td>
<td>0.2</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*One-way analysis of variance or t-test was used to compare group means.
diarrhoea incidence, may be the most important factor determining nutritional status in rural Bangladesh.

Our findings are at odds with those of previous studies from St Lucia (Henry, 1981), Lesotho (Esrey et al., 1988) and Nigeria (Hutchey et al., 1989), which suggested that improvements of water supply and sanitation had a favourable impact on the nutritional status of children. This may be due to different levels of diarrhoea incidence, of malnutrition, or of food availability in different settings. It may be also that in these projects, nutritional status improved independently of the effect that the water supply had on the prevalence of diarrhoea. The study from Lesotho reported an improvement of nutritional status despite only higher diarrhoea rates in children from families who had access to improved water supply (Esrey et al., 1988). Provision of water near the house saves time for the mothers who become available for child care and this may also explain some of the findings.

Trace element composition of different sources of water were examined and it may also explain an effect of water supply on growth independent from diarrhoea. Maybe the lower nutritional status observed in this study among children from households exclusively using handpump water can be explained in these terms.

The level of input also varies between studies and this may explain the difference of the results: water and sanitation interventions may have an effect on diarrhoea morbidity only at a low level of environment contamination has been reached (Kawata, 1978; Shuval et al., 1989).

In summary, this study suggests that the impact of water and sanitation interventions may remain undetected if assessed by measures of nutritional indicators and that measures of diarrhoea indicators are still needed to assess their efficacy. It also suggests that water and sanitation interventions, however useful they may be to prevent diarrhoea, may not be an effective approach to prevent malnutrition in many areas of rural Bangladesh.

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References


