The impact of a nutrition education programme on the anthropometric nutritional status of low-income children in South Africa

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Abstract

Objective: The study determined the impact of a community-based nutrition education programme, using trained community nutrition advisors, on the anthropometric nutritional status of mixed-race children aged between 2 and 5 years.

Design and setting: The programme was implemented over two years in four study areas in the Free State and Northern Cape Provinces. Two control areas were included to differentiate between the effect of the education programme and a food aid programme that were implemented simultaneously. Weight-for-age, height-for-age and weight-for-height were summarised using standard deviations from the NCHS reference median. For each of the indicators, the difference in the percentage of children below minus two standard deviations from the reference NCHS median in the initial and follow-up surveys was determined.

Subjects: Initially 536 children were measured and, after two years of intervention, 815.

Results: Weight-for-age improved in all areas, but only significantly in boys and girls in the urban study area, and in boys in one rural study area. No significant improvement in height-for-age occurred in any area. Weight-for-height improved significantly in the urban study area.

Conclusion: The education programme in combination with food aid succeeded in improving the weight status of children, but was unable to facilitate catch-up growth in stunted children after two years of intervention.

Keywords

Anthropometry
Integrated nutrition education programme

According to the United Nations (International) Children’s (Emergency) Fund (UNICEF)¹, all people have the right to be free from hunger and malnutrition. Despite this basic human right, about 150 million children under 5 years old are underweight, and another 20 million suffer from severe malnutrition¹. In South Africa, the previous lack of a national nutrition surveillance programme has made it difficult to determine the prevalence of malnutrition. Single studies seem to indicate, however, that it is as high as 30% in African and mixed-race children. The extent of nutritionally related diseases in African²⁻¹₅ and mixed-race¹₆⁻²₀ communities in South Africa seems to indicate that dietary practices leave much to be desired.

The implications of malnutrition are considerable, not only as a health problem, but also as a developmental and economic problem. While considerable effort has been made to determine the prevalence of malnutrition, much less attention has been given to prevention. Yet, information about prevalence is of little value unless related to action.

The Nutrition Education Intervention Programme (NEIP) has been developed based on the nutrition education programme of the previous Administration: House of Representatives, to address the malnutrition problem of low-income children of mixed race in the Free State and Northern Cape Provinces.

Subjects and methods

The NEIP consisted of an intensive nutrition education programme implemented with the help of nutrition advisors, appointed as community health workers and remunerated by the government. Advisors are local respected members of communities with nutrition as
first priority. Advisors were trained and supervised in the
community, with each month in the two-year implement-
tation period devoted to a different topic of nutrition (all
topics were covered twice). The programme was adapted
to local conditions, depending on specific needs. While
nutrition advisors were in training they were visited every
d second week by a supervisor and at least once a month
after training was completed.

Nutrition advisors concentrate on improving nutritional
knowledge about a variety of relevant topics such as
balanced meals, food purchasing and preparation, and
nutrition during the different life cycles. Advisors are also
involved in nutrition monitoring (growth and breast-
feeding) and community development. An objective of
the NEIP is to equip communities with knowledge
through practical instruction including demonstration,
role-play, exhibitions, workshops and home visits. Com-
munities are encouraged to participate by planning
actions to generate income and improve household
food security. Such plans include women’s sewing groups
and vegetable gardening projects.

At the time of the study a food aid programme, The
National Nutrition and Social Development Programme
(NNSDP), was implemented by the government. Needy
families were provided with food parcels including staple
foods such as corn meal, oil, legumes and milk powder.
The food aid programme and the NEIP were implemen-
ted in study areas. In the two control areas the food aid
programme was implemented, but no nutrition education
was given.

The townships that were included are all relatively
uniform as regards climate, socio-economic status and
health services. No major nutrition interventions had
previously been implemented in the sample areas. An
urban area (Heidedal), a large rural area (Ritchie) and two
small rural areas (Jagersfontein and Fauresmith) com-
prised the study areas. For practical reasons, two rural
control areas (Trompsburg and Bethulie) were included
because they are relatively close to the other towns and
the NNSDP had not been launched in these areas at that
time. An urban control area was not included. This may
be considered a limitation of the study, but since nutrition
advisors had been appointed in all other urban areas in
the two provinces, no urban control area remained. In
addition, the results of a representative household survey
indicated that the level of nutritional knowledge in the
urban area was generally no different from that in the
rural areas.

All children aged 2 to 5 years were included (mean age
ranged from 3.7 years in Bethulie to 4.2 years in
Trompsburg for boys and from 3.8 years in Bethulie to
4.3 years in Fauresmith for girls). Initially 536 children
were weighed and measured and, after two years, 815
children were included.

Children were weighed to the nearest 0.2 kg without
shoes and heavy clothing. Scales were calibrated before
use, and again after every 20 children were weighed.
Height was measured using an accurate, non-stretchable
measuring tape that was securely fastened to a wall.
Children were measured without shoes, standing against
the wall with heels touching the wall. A 90° triangle was
used to read the standing height accurately, to the nearest
0.1 cm.

Indices used for the interpretation of weight and height
include weight-for-age, height-for-age and weight-for-
height\(^2\). Results were compared with the National Center
for Health Statistics (NCHS) references, which were
developed using data from the Fels Research Institute
and US Health Examination Surveys\(^2\). Below minus two
standard deviations (−2SD) from the NCHS median has
been used as cut-off point to identify low weight-for-age
(underweight), low height-for-age (stunting) and low
weight-for-height (wasting). The differences in the
percentage of children with anthropometric indicators
below −2SD before and after intervention were deter-
mined in accordance with World Health Organization
(who) recommendations\(^2\) and the 95% confidence
interval (CI) calculated to indicate significance of differ-
ences.

**Results**

**Weight-for-age**

Initially, the percentage of children in Heidedal with a
weight-for-age below −2SD (severely underweight) was
34.8% for boys and 32.2% for girls. In the rural areas it
ranged from 23.8% in Jagersfontein to 45.5% in Ritchie
for boys and from 15.0% in Bethulie to 65.0% in Trompsburg
for girls. Also cause for concern is the large percentage
of boys and girls in each area that have a weight-for-age
between −2SD and −1SD, and who are thus at risk of
becoming more seriously underweight (Table 1).

The percentage of severely underweight children
decreased quite dramatically between the two surveys
in most sample areas (significantly for boys and girls in
Heidedal and for boys in Ritchie) (Table 4). In Heidedal, it
had more than halved after two years of nutrition
intervention. The same trend was observed in the boys
in Ritchie, where severe underweight decreased from
45.5% to only 23.9% (Table 1). In the remaining two study
areas and control areas an improvement was also
observed (with the exception of girls in Bethulie). The
small sample sizes make it difficult, however, to interpret
the data in these areas.

As a result of the decrease in severely underweight
children, the percentage of less severely underweight or
normal weight children (weight-for-age above −2SD)
increased.

**Height-for-age**

During the initial survey 27.6% of boys and 23.8% of girls
in Heidedal were stunted (height-for-age below −2SD).
In rural areas stunting ranged from 20.0% in Bethulie to 81.3% in Fauresmith. As with weight-for-age, a large percentage of children had a height-for-age between −2SD and −1SD. In contrast to the weight-for-age findings, the percentage of stunted children actually increased after intervention (by as much as 8.6% for boys and 11.1% for girls in Heidedal). The prevalence of stunting decreased by 13.6% for boys in Ritchie and by 23.6% for girls in Trompsburg, but in other study and control areas the percentage of children with a height-for-age below −2SD either increased (significantly in Jagersfontein) or remained essentially the same (Table 2). Again it must be emphasised that the data of small rural sample sizes must be interpreted cautiously, since the data of one child can affect the results significantly.

### Table 1 Weight-for-age

<table>
<thead>
<tr>
<th></th>
<th>Study areas</th>
<th>Control areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heidedal</td>
<td>Ritchie</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Boys</td>
<td>n = 141</td>
<td>n = 152</td>
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<tr>
<td>SD*</td>
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<td></td>
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<tr>
<td>&lt; −3</td>
<td>12.1</td>
<td>0.7</td>
</tr>
<tr>
<td>−3 to −2</td>
<td>22.7</td>
<td>7.9</td>
</tr>
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<td>−2 to −1</td>
<td>32.6</td>
<td>27.6</td>
</tr>
<tr>
<td>−1 to 1</td>
<td>29.8</td>
<td>58.6</td>
</tr>
<tr>
<td>≥1</td>
<td>2.8</td>
<td>5.3</td>
</tr>
<tr>
<td>Girls</td>
<td>n = 143</td>
<td>n = 186</td>
</tr>
<tr>
<td>SD*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; −3</td>
<td>13.3</td>
<td>1.6</td>
</tr>
<tr>
<td>−3 to −2</td>
<td>18.9</td>
<td>10.8</td>
</tr>
<tr>
<td>−2 to −1</td>
<td>27.3</td>
<td>27.4</td>
</tr>
<tr>
<td>−1 to 1</td>
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</tr>
<tr>
<td>≥1</td>
<td>2.8</td>
<td>8.1</td>
</tr>
</tbody>
</table>

* Standard deviation (SD) from the reference NCHS median.
1 = Before intervention; 2 = after intervention.

### Table 2 Height-for-age

<table>
<thead>
<tr>
<th></th>
<th>Study areas</th>
<th>Control areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heidedal</td>
<td>Ritchie</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Boys</td>
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<td>n = 152</td>
</tr>
<tr>
<td>SD*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; −3</td>
<td>9.9</td>
<td>12.5</td>
</tr>
<tr>
<td>−3 to −2</td>
<td>17.7</td>
<td>23.7</td>
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<tr>
<td>−2 to −1</td>
<td>22.7</td>
<td>36.2</td>
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<tr>
<td>−1 to 1</td>
<td>42.6</td>
<td>22.4</td>
</tr>
<tr>
<td>≥1</td>
<td>7.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Girls</td>
<td>n = 143</td>
<td>n = 186</td>
</tr>
<tr>
<td>SD*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; −3</td>
<td>9.8</td>
<td>9.1</td>
</tr>
<tr>
<td>−3 to −2</td>
<td>14.0</td>
<td>25.8</td>
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<tr>
<td>−2 to −1</td>
<td>25.9</td>
<td>29.6</td>
</tr>
<tr>
<td>−1 to 1</td>
<td>41.3</td>
<td>33.3</td>
</tr>
<tr>
<td>≥1</td>
<td>9.1</td>
<td>3.2</td>
</tr>
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</table>

* Standard deviation (SD) from the reference NCHS median.
1 = Before intervention; 2 = after intervention.

### Weight-for-height

The prevalence of wasting (weight-for-height below −2SD) was relatively low in all rural areas (ranging from 0% in Jagersfontein and Fauresmith to 13.7% in Ritchie), but higher in urban Heidedal (21.3% for boys and 21.7% for girls). This difference is probably due to a more acute food shortage in Heidedal than in the rural areas, where stunting due to chronic malnutrition often results in a ‘normal’ weight-for-height, despite the low weight-for-age.

A decrease in the percentage of wasted children was observed after intervention in most sample areas (Table 3). The difference was significant in Heidedal where it decreased to 0.7% in boys and 2.7% in girls (Table 4), the reason being that a larger proportion of urban children were wasted during the initial survey, leaving room for...
improvement. In rural areas the prevalence of stunting decreased further, or remained as low as in the initial survey. Either no change or a decrease in the percentage of children with a weight-for-height between $-2 SD$ and $-1 SD$ was also noted.

### Discussion

Anthropometric data serve as indicators of various factors, including dietary practices. Advantages of anthropometry above other methods of determining nutritional status in communities have been established\(^1\). Although there is controversy regarding the use of growth standards for all ethnic groups\(^2\), the use of the NCHS data as references in all communities is indicated\(^2\). Nevertheless, it is important to note that improved anthropometry is not necessarily the most important objective of intervention, nor is it always the best measure of its success\(^2\).

The nutritional status of mixed-origin children has been reported to be less than satisfactory in other relevant studies\(^3\). According to Steyn et al.,\(^3\) the largest percentage of children with reduced height and weight in South Africa are rural children of mixed origin. In the light of such findings, the importance of implementing programmes such as the NEIP in needy communities is warranted.

### Weight-for-age

A weight-for-age below $-2 SD$ is indicative of underweight, which usually occurs after a period of recent food shortage\(^4\). This index, however, fails to differentiate between children who are tall and thin and children who are short with an adequate weight\(^5\). The prevalence of underweight in our study was similar to that found by other researchers using the third percentile (which corresponds to $-2 SD$) as cut-off point\(^6,7\). In a study undertaken amongst 11-year-old children by Steyn et al.,\(^8\), the prevalence of underweight was lower than that found in our study (28% using the fifth percentile as cut-off point).

After two years of nutrition intervention, the prevalence of underweight had decreased in both the study and control areas, but only significantly in two study areas. A combination of nutrition instruction and food aid is, apparently, more beneficial in improving weight-for-age than food aid in isolation. These results are similar to those found at Pholela Health Centre in rural Natal, South Africa, where a significant improvement in weight-for-age was found after community-based nutrition education focusing on mothers and infants\(^9\).

### Height-for-age

A height-for-age below $-2 SD$ is indicative of stunting, which usually occurs after a period of chronic malnutrition\(^10\). Waterlow et al.\(^10\) reported that height-for-age is the most suitable indicator of past nutrition and, according to Gorstein et al.\(^11\), stunting is also commonly associated with poor socio-economic conditions. The prevalence of stunting was high before intervention (approximately one-quarter of urban and almost half of rural children), with no marked differences between boys and girls. The fact that socio-economic conditions are generally better in urban areas could possibly explain the lower prevalence of stunting in Heidedal. The prevalence of stunting in our study is, however, higher than that found in mixed-origin children by other researchers. Such studies include that of Margo et al.,\(^12\), who reported stunting figures of 16.1% among urban children between 1 and 16 years old. Similarly, Steyn et al.\(^13\) reported that 32% of 11-year-old children were stunted, using the fifth percentile as cut-off point.

In contrast to weight-for-age, no significant improve-

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**Table 3 Weight-for-height**

<table>
<thead>
<tr>
<th>Study areas</th>
<th>Heidedal</th>
<th>Ritchie</th>
<th>Jagersfontein</th>
<th>Fauresmith</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys SD(^*)</td>
<td>141 152</td>
<td>44 138</td>
<td>21 38</td>
<td>21 20</td>
</tr>
<tr>
<td>$&lt;-3$</td>
<td>5.0 0.0</td>
<td>2.3 0.0</td>
<td>0.0 0.0</td>
<td>0.0 0.0</td>
</tr>
<tr>
<td>$-3$ to $-2$</td>
<td>16.3 7.0</td>
<td>11.4 5.8</td>
<td>0.0 0.0</td>
<td>0.0 0.0</td>
</tr>
<tr>
<td>$-2$ to $-1$</td>
<td>31.9 7.2</td>
<td>27.3 25.4</td>
<td>9.5 0.0</td>
<td>19.1 5.0</td>
</tr>
<tr>
<td>$-1$ to 1</td>
<td>43.3 67.1</td>
<td>56.8 67.4</td>
<td>71.4 63.2</td>
<td>71.4 70.0</td>
</tr>
<tr>
<td>$\geq1$</td>
<td>3.5 25.0</td>
<td>2.3 1.5</td>
<td>19.1 36.9</td>
<td>9.5 25.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control areas</th>
<th>Trompsburg</th>
<th>Bethulie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls SD(^*)</td>
<td>143 186</td>
<td>50 147</td>
</tr>
<tr>
<td>$&lt;-3$</td>
<td>7.0 0.0</td>
<td>8.0 0.7</td>
</tr>
<tr>
<td>$-3$ to $-2$</td>
<td>14.7 2.7</td>
<td>2.0 2.7</td>
</tr>
<tr>
<td>$-2$ to $-1$</td>
<td>31.5 6.5</td>
<td>32.0 21.8</td>
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<td>$-1$ to 1</td>
<td>43.4 61.3</td>
<td>58.0 70.1</td>
</tr>
<tr>
<td>$\geq1$</td>
<td>3.5 29.6</td>
<td>0.0 4.8</td>
</tr>
</tbody>
</table>

\(^*\) Standard deviation (SD) from the reference NCHS median.

1 = Before intervention; 2 = after intervention.
ment in height-for-age was observed after intervention. Weight is the first indicator to respond to nutrition intervention, with linear growth retardation taking much longer to be remedied. Stunting is a condition that occurs as a result of prolonged malnutrition. Just as it takes longer to develop stunting than underweight, so it possibly also takes longer for catch-up growth to occur in stunted children. It is also unlikely that stunted children will ever reach their full growth potential. Controversy exists regarding the benefits of food aid for stunted children. Despite supplementation, studies have reported that significant catch-up growth does not necessarily occur in stunted children living in low socioeconomic conditions who receive food aid after the age of 1 year or 3 years. In the light of these findings, it is recommended that stunting be prevented by ensuring optimal nutrition for infants. The benefits of good breastfeeding and weaning practices in this regard are obvious. In addition to food aid, it seems reasonable to suggest that poor environmental conditions, such as household food insecurity, ineffective health care, poor housing and unemployment, need to be addressed in intervention programmes aimed at reducing the prevalence of stunting. Although the NEIP was concerned with increasing household food security by improving knowledge of nutrition, promoting breast-feeding and encouraging income generation, problems such as inadequate housing and health services were beyond the scope of the programme.

### Weight-for-height

A weight-for-height below −2SD is an indication of wasting that usually occurs after a period of recent and severe malnutrition. According to Waterlow et al., weight-for-height is the most suitable indicator of the present state of nutrition. In contrast to the high prevalence of wasting reported in other studies, fewer urban and rural children in our study were wasted. As found in other studies, the prevalence of wasting in our study was lower than that of underweight and stunting. In the urban area of Heidedal, however, the percentage of stunted children was higher than in rural areas. It is possible that these children had failed to gain weight or had lost weight shortly before the initial survey for some reason. The significant improvement in height-for-age was observed after intervention. Weight is the first indicator to respond to nutrition intervention, with linear growth retardation taking much longer to be remedied.

### Conclusion

In interpreting the results obtained by the three chosen indicators, it is important to note that an acute food shortage will undoubtedly produce thin children, irrespective of their height or age. An increase in food intake will improve the weight-for-height and weight-for-
age of malnourished children, but it may not necessarily affect the height-for-age.

In this study the prevalence of stunting was generally found to be high, with low wasting. Rural areas were more seriously affected than the urban area. According to Gorstein et al., this situation is common in communities where socio-economic conditions are poor. The NEIP in combination with food aid succeeded in improving the weight status of children, but was unable to facilitate catch-up growth in stunted children after two years of intervention.

It is recommended that socio-economic variables, such as sanitation, housing, literacy and employment, be included in integrated interventions if the overall prevalence of stunting is to be decreased.

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