The Prevalence of Wasting, but Not Stunting, Has Improved in the Democratic People’s Republic of Korea

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ABSTRACT The Democratic People’s Republic of Korea (DPRK) is one of the nutritionally vulnerable countries of the world. The objectives of this paper were to determine the current prevalence of undernutrition among children using data from the latest national survey and to compare the findings with those from the previous national survey in 1997. In 2002 with cooperation from UNICEF and the World Food Program (WFP), the government of the DPRK conducted a survey of 6000 households with children < 7 y old using multiple-stage sampling methods. Data were collected for sociodemographic variables, use of WFP food aid, and anthropometric measures of the youngest child in the household. The prevalence of stunting (height for age Z-score less than −2.0) in all children was 39.4% (40.2 and 38.5% for boys and girls, respectively). The prevalence of wasting (weight for height Z-score less than −2.0) was 8.2% in all children (9.1 and 7.3% for boys and girls, respectively). Although the prevalence of wasting has decreased from 1997 (16.5%) to 2002 (8.2%), the prevalence of stunting has not changed between those years, 38.2 vs. 39.4%. Thus, we conclude that acute undernutrition is decreasing in the DPRK, but chronic undernutrition that results in stunting is still highly prevalent. Continued surveillance of nutritional status of children in the DPRK is warranted given the continued state of undernutrition in that country. J. Nutr. 135: 452–456, 2005.

KEY WORDS: • undernutrition • stunting • wasting • children • North Korea

The prevalence of wasting and stunting in children < 5 y old decreased in most developing nations between 1990 and 2000 (1). The decreased prevalence of stunting throughout the world is associated with improved water sanitation, increased food supply, increased education of women, as well as improved treatment of acute and infectious diseases (2–5). However, ~150 million children continue to suffer from undernutrition and many survive, often remaining growth retarded or stunted, defined as a height-for-age Z-score (HAZ)² less than −2.0 (6,7). In particular, underweight and stunting are still highly prevalent in countries that are economically unstable due to conflict or isolation (8). The reason for the high prevalence of undernutrition in these countries stems from continued civil unrest, infectious disease outbreaks, increased food insecurity, poorly managed or nonexistent national public health ministries, and difficulties experienced by nongovernmental organizations (NGOs) attempting to deliver food aid. Such is the case in the Democratic People’s Republic of Korea (DPRK), where food aid and economic development have met challenges attributed to international isolation, a strict political system, and natural disasters, resulting in documented cases of severe starvation and increased levels of food shortage across the lifespan.

The population of the DPRK now exceeds 23 million and is facing continued economic and political difficulties that impede development efforts. Since the fall of the Soviet Union in 1989, communist societies, such as the DPRK, have struggled to maintain viable economies, but have experienced a deterioration of agricultural and health systems. The DPRK has experienced a 30% contraction in its economy, limiting its ability to purchase foreign food to balance production inadequacies (9). For the DPRK, in particular, this situation has been made worse by recurring environmental disasters, including hailstorms in 1994, floods in 1995, and droughts in 1997 and 2000 (9). Recent rainstorms in the northern Provinces destroyed key roads and bridges, and damage to cereals pipelines, major trade routes that transport cereals to rural provinces, prevented almost 3 million children from receiving aid from the World Food Program (WFP) (9). These events have taken a cumulative toll on the overall state of nutrition in the DPRK, in general, and on the health of children, in particular.

The current state of food supply in the DPRK is precarious. Between 1989 and 2001, there was a decrease of 240 kJ in per capita food supply, even among major food products, such as cereal, meat, eggs, and vegetable oil (10). The per capita supply of protein and fat has decreased by 286 and 357 kJ, respectively (10). Efforts to reverse this trend are challenged by the fact that the DPRK remains politically and economically isolated, but relief efforts by WFP and other NGOs have provided food aid to 161 of a total 203 districts (85% of the population) (11). Still, the feasibility of continuing these programs in the long term is questionable and the need to assess the nutritional health of children requires surveys that...
SUBJECTS AND METHODS

This study used data from the Nutrition Assessment 2002 conducted by the government of the DPRK (23), in cooperation with UNICEF and the WFP. Access to this dataset was obtained through a cooperative agreement with officials from UNICEF.

Sample design. The DPRK is divided into 9 provinces and 3 municipal cities that are further divided into Ri (village for rural counties) or Dong (neighborhood for urban counties or cities). The Primary Sampling Unit (PSU) was formed by randomly selecting 200 Ri or Dong in 7 provinces and 3 cities based on the ratio of 20 urban/10 rural Ri/Dong. If a PSU was located in a region that was not accessible to UNICEF, the next PSU in the random list was selected until a PSU in an accessible county was chosen. For each PSU selected, 1 nursery was randomly selected for the survey and 2 children from the enrollment list were randomly selected to be included in the survey. The families of these children became the index household and 14 families with children < 7 y old and living close to each index household were randomly selected to become the Secondary Sampling Unit.

Subjects. Children < 7 y old were selected from 30 randomly chosen households in 7 provinces and 3 cities in the DPRK. This provided 6000 households from which 1 child was selected for the study. For families that had more than 1 child, the last child born was enrolled in the survey.

Administration of questionnaires. Each household selected was visited by a member of the survey team who administered a questionnaire to assess household food availability and source of food, maternal food intake and frequency, and general health questions.

Anthropometric measurements. Data collection was completed by a team of trained staff members from the DRPK Central Bureau of Statistics using the standardized protocol established by the WHO. Each child selected and his/her mother had their weight, height, and mid-upper arm circumference measured. Weight was measured with a UNISCALE, and height/length was measured with a wooden board specially developed for this project. UNICEF provided plastic insertion tapes that were used to measure mid-upper arm circumferences of children under 2 y. Anthropometric measurements were conducted following the manufacturer’s instructions and the UNICEF recommendations. All staff received follow-up training based on the standards established by the WHO as described in Nutrition Assessment 2000 DPRK (11). We used the WHO definition of stunting and wasting in which stunting is defined as an HAZ of -2.0 or lower, and wasting is defined as a weight-for-height Z-score (WHZ) of -2.0 or lower, relative to the NCHS/WHO reference (26).

The World Food Program. The DRPK, a communist country, supplies foods to the population through a public distribution system, rather than through markets often seen in capitalist countries. Because this food distribution system has not been sufficient to ensure adequate nutrient intake for all citizens, the use of food assistance from international organizations, such as the WFP is required. Therefore, mothers of the children were asked to identify the main source of foods for the household. In this paper, the children in households that used the WFP food aids as a main source of foods stored by the household were compared with those in households that reported “other” (e.g., public distribution system) as a main source of foods. Mothers were also asked if they received food supplements (e.g., 300-kcal biscuits) from the WFP.

Statistical methods. Means ± SD are presented in the tables and differences between sexes for subject characteristics were assessed with Student’s t test (SPSS for Windows 10.0). Logistic regression was used to explore factors (child’s age and sex and mother’s age and education) that might be associated with stunting and wasting (11) and odds ratios (OR) were estimated from these equations (SAS Institute). Differences were considered significant at \( P < 0.05 \) and 95% CI were calculated for the OR.

RESULTS

Boys and girls did not differ with respect to anthropometric measurements, age, or maternal age and weight (Table 1). HAZ was \(-1.72 \pm 0.99\), WHZ was \(-0.50 \pm 1.01\), and WAZ was \(-1.48 \pm 0.86\); boys and girls did not differ for these variables. Of the children examined, 7.4% lived in households that identified food aid from the WFP as their main food source and 5.5% reported having received the supplement from the WFP. These data were reported as household, not individual, use of the food aids and supplements from the WFP.

For the entire 6000 child sample, 39.4% were stunted and 8.2% were wasted (Table 2). When the data were split by sex, 40.2 and 9.1% of the boys were stunted and wasted, respectively. Among girls, 38.5% were stunted and 7.3% were

<table>
<thead>
<tr>
<th>Variable</th>
<th>All children</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>6000</td>
<td>3115</td>
<td>2885</td>
</tr>
<tr>
<td>Age, y</td>
<td>2.55 ± 1.77</td>
<td>2.55 ± 1.76</td>
<td>2.55 ± 1.78</td>
</tr>
<tr>
<td>Height, cm</td>
<td>82.3 ± 14.1</td>
<td>82.9 ± 14.0</td>
<td>81.7 ± 14.1</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>10.85 ± 3.38</td>
<td>11.09 ± 3.40</td>
<td>10.59 ± 3.35</td>
</tr>
<tr>
<td>Maternal age, y</td>
<td>30.75 ± 4.11</td>
<td>30.74 ± 4.10</td>
<td>30.77 ± 4.13</td>
</tr>
<tr>
<td>Maternal weight, Kg</td>
<td>49.57 ± 5.33</td>
<td>49.51 ± 5.18</td>
<td>49.63 ± 4.13</td>
</tr>
<tr>
<td>HAZ</td>
<td>-1.72 ± 0.99</td>
<td>-1.76 ± 0.98</td>
<td>-1.68 ± 1.01</td>
</tr>
<tr>
<td>WHZ</td>
<td>-0.50 ± 1.01</td>
<td>-0.53 ± 1.01</td>
<td>-0.46 ± 1.01</td>
</tr>
<tr>
<td>WAZ</td>
<td>-1.48 ± 0.86</td>
<td>-1.51 ± 0.84</td>
<td>-1.45 ± 0.88</td>
</tr>
<tr>
<td>WFP foods, %</td>
<td>7.4</td>
<td>7.2</td>
<td>7.6</td>
</tr>
<tr>
<td>WFP supplements, %</td>
<td>5.5</td>
<td>5.6</td>
<td>5.4</td>
</tr>
</tbody>
</table>

1 Values are means ± SD or %.
2 The percentage of households responding that they used WFP Foods as their primary source of food.
3 The percentage of households responding that they used WFP Food Supplements.
wasted. The distribution of HAZ was below that for the NCHS/WHO reference (26) (Fig. 1A) and was consistent with a high prevalence of stunting. The WHZ was normally distributed (Fig. 1B) and similar to that expected from the NCHS data. The prevalence of stunting (Table 2) by year of age for children ≥ 1 y old was similar (between 41.4 and 47.9%), whereas 21% of children < 1 y old were stunted. Wasting (Table 2) was most prevalent in children 1–2 y old (12.8%) and, except for those in the 1- to 2-y range, all children had a similar prevalence of wasting (between 6.0 and 8.1%).

Possible factors that may be related to risks of stunting and wasting were explored with logistic regression analysis (Table 3). The risk for being stunted was higher for older children and children born to younger mothers (OR = 1.22, 95% CI: 1.18, 1.27) and lower for children from families reported using WFP Food Aid as the primary source of food (OR = 0.73, 95% CI: 0.56, 0.94). When the use of WFP supplements was substituted for the use of WFP Food Aid, the risk of stunting was increased for older children and children born to young mothers, but decreased for children whose families reported use of WFP supplements (OR = 1.23, 95% CI: 1.18, 1.27; OR = 0.98, 95% CI: 0.96, 0.99; OR = 0.62, 95% CI: 0.50, 0.78, respectively).

With respect to wasting (Table 4), when analyzed with the use of WFP Food Aid as the primary source of food, older

![Figure 1](https://academic.oup.com/jn/article-abstract/135/3/452/4663672/Downloaded-from-https://academic.oup.com/jn/article-abstract/135/3/452/4663672 by guest on 20 January 2019)
children had a borderline significant decreased risk of being wasted (OR = 0.93, 95% CI: 0.87, 1.00) and boys had an increased risk of wasting (OR = 1.28, 95% CI: 1.06, 1.54). When WFP supplement use was included in the analysis, the same pattern was found in which the risk for wasting was decreased among older children and increased for boys (OR = 0.93, 95% CI: 0.87, 0.99 and OR = 1.28, 95% CI: 1.06, 1.54, respectively). The use of WFP Food Aid or supplements did not influence the risk of being wasted.

DISCUSSION

The prevalence of stunting has decreased throughout the world, but the prevalence of undernutrition and starvation remains relatively high in many developing nations (1,7). Efforts to reduce the prevalence of stunting and wasting, when available or accepted by the country in question, have focused on providing humanitarian and technical assistance to improve both dietary intake and overall health. The DPRK is an example of a country that is suffering unknown fallout from its economic and political isolation, coupled with military spending that exceeds 20% of the gross domestic product (27), but continued efforts to provide food aid have been successful (11). The objective of this paper was to document the state of nutrition for children living in the DPRK and to explore those factors that are associated with stunting among children. Based on a survey of 6000 households in the DPRK, stunting and wasting continue to be major public health problems for that country’s children.

In 1998 Katona-Apte and Mokdad reported that the prevalence of stunting and wasting in the DPRK was 39.6 and 17.4% among boys and 36.8 and 15.5% among girls (24). This suggests that, in 2002, stunting is still highly prevalent, whereas wasting is less prevalent (Fig. 2). However, it should be noted that the sampling methodologies used in the 2 surveys were different. The earlier survey was conducted among 3965 children in selected nurseries and kindergartens in 4 provinces (Kangwon, South Hwanghae, South Pyongan, and South Hamgyong), whereas the 2002 survey utilized a multistage random sampling method to obtain a sample of 6000 children with a wider age range and from more provinces in the country (7 provinces and 3 cities). Given that the 2 surveys did not use the same sampling protocol, comparing the results between them may not provide a complete understanding of the changes in the undernutrition status in the DRPK. However, they are the only data available on the children in the DRPK, and the surveys were conducted through direct involvement of or in collaboration with the UNICEF. Therefore, the comparison will allow us to understand the general direction of the trend in the nutritional status of the children in the DRPK.

The prevalence of wasting decreased, whereas that of stunting did not change between 1997 and 2002 (24). Although the prevalence of wasting was normally distributed, the distribution of HAZ had a trimodal distribution. We have no definitive reason for this distribution, but possible explanations include a disproportionate number of children > 1 y old in the survey, measurement error, or an effect of rounding of age to years. Regarding the first explanation, ~80% of the 6000 children measured were > 1 y old and the mean HAZ of these children was −1.86 compared with those < 1 y old whose mean HAZ was −1.25. When these children were excluded from the dataset, the distribution pattern persisted, suggesting that the first explanation is unlikely. For the second possibility, given that the distribution for WHZ was normal, it is not likely to result from measurement error, but this cannot be ruled out completely. Finally, we examined the data for HAZ using both years of age as well as months of age and found the same distribution pattern. In addition, we used smaller groupings of HAZ, defining them by 0.25 Z-score and the same distribution occurred. Thus, we are not able to explain exactly why there was a larger frequency of stunted children between −3.00 and −3.50 and between −2.00 and −2.50 compared with the other Z-scores because there is no apparent biological or statistical explanation for this observation.

Although our analysis of factors associated with growth retardation was limited by the lack of some relevant variables, such as monthly income and sanitation history, the results tend to support those reported by others (2). That is, girls and children born to younger mothers are more likely to be stunted or wasted, but maternal education was not a significant predictor of stunting. This is of particular interest because several previous studies reported a significant negative relation be-
between maternal education and degree of growth retardation (2,5). Why our results for these 2 decidedly important factors differ from other studies is a difficult question given the large number of households surveyed. One possible explanation could be that the socioeconomic status of citizens living outside of the capital, Pyongyang, does not vary widely between households. This would basically leave us with a sample of mothers and children who vary in few real ways, especially education and nutritional status. At the same time, it is important to take away the indirect message of this discrepancy, i.e., that food aid in and of itself is only one factor that can promote nutrition in impoverished areas of the world. It is important to continue to improve women’s status and education, and this should be integrated into long-term development programs.

The results of this survey provide encouraging evidence that acute undernutrition in the DPRK has abated somewhat, but there is substantial evidence that chronic, mild undernutrition exists and is leaving a large proportion of children growth retarded. This observation has important long-term implications because recent studies suggest that a positive relation exists between stunting and poor physical outcomes (12,13,28–33). In addition, growth retardation is also associated with impaired cognitive functioning (17,18,34). Taken as a whole, growth retardation can leave an individual physically (20,35,36) and cognitively less able to contribute to the workforce, a significant factor that may influence productivity and overall development.

In conclusion, we found that the prevalence of stunting remains high in the DPRK, whereas the prevalence of wasting appears to have declined since 1997. Continued efforts to improve nutritional status among children in the DRPK are warranted.

LITERATURE CITED