Original research

In the shadow of the volcanoes: the impact of intervention on the nutrition and health status of Rwandan refugee children in Zaire two years on from the exodus

Andre Renzaho and Catherine Renzaho

Abstract

Objective: To evaluate the public health and nutritional situation of refugee children in Katale camp, Eastern Zaire, after two years of nutritional and health intervention from 1994 to 1996.

Design: Cross-sectional survey using a two-stage cluster sampling method. Anthropometric data were collected from 28 May 1996 to 4 June 1996. Retrospective review of food basket monitoring data over the preceding six months and the United Nations High Commission for Refugees’ weekly mortality data was conducted. Measles immunisation coverage data were surveyed simultaneously, using child health records.

Main outcome measures: Nutritional status measured by weight-for-height index (W/H), measles immunisation status, average daily energy content of the general food ration and crude mortality rate.

Setting: Katale refugee camp, Zaire, June 1996.

Analysis: Weight-for-height index and proportion of immunised children were computed using EPINUT, part of EPINFO computer package.

Results: Malnutrition was found to be most prevalent in children aged six to 29 months old (W/H < -2 Z-score and/or oedema: 6.2%; 95% CI: 3.4%, 10.6%), among whom the malnutrition rate was almost double the overall malnutrition prevalence (W/H < -2 Z-score and/or oedema: 3.5% (95% CI: 1.5%, 7.2%). The general food ration, although conforming to the World Food Program minimum standards of adequacy in terms of variety (being composed of cereals, oil, beans, blended cereal and legume mixes and salt), provided only 6240 kJ on average (95% CI: 5040, 7140 kJ) per person per day, thus meeting only 57% to 84% of the minimum energy requirements for an adult, and falling well below the needs for sub groups with higher nutritional requirements such as children, pregnant and breastfeeding women and the sick. Measles immunisation coverage in children nine to 59 months was 88.6%. The crude mortality rate was found to be 0.3 per 10 000 per day. Refugees received 15 litres of clean water per person per day.

Conclusion: Public health interventions in Katale camp 1994 to 1996 had reduced mortality and morbidity rates dramatically. This was not reflected in the malnutrition rates for children under five years, that remained stable after an initial fall despite two years of nutritional intervention. The factors contributed to this were related to an inadequate general food ration (due to food shortages), lack of ability to supplement the diet, (due to economic restrictions that were imposed in the camp) and inequities in the food distribution process (due to food being siphoned off by camp leaders for military purposes).

Key words: refugee camp, Zaire, malnutrition, children, chronic emergency

At the time of the evaluation Andre Renzaho was the Nutritionist with Care Australia and Catherine Renzaho (then known as Catherine Lyons) was the Medical Coordinator of Katale Camp, and Medical Coordinator with Care Australia.

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Introduction

Following the genocide in Rwanda in 1994, in the Great Lakes area of East Africa there was an efflux of Rwandan refugees crossing the borders to neighbouring countries and approximately 1.1 million found refuge in the former Zaire, and in particular eastern Zaire. Of these, approximately 500 000 to 800 000 refugees lived in four refugee camps in the North-Kivu region, flanking the western frontier with Rwanda, the Mugunga camp, Kibumba camp, Kahindo camp and Katale camp, each in the shadow of the active volcanoes around the Goma area. As a consequence of volcanic eruptions in the 1970s, these refugees who fled to eastern Zaire after the 1994 genocide in Rwanda found themselves living in camps built on old lava that was agriculturally unproductive.

One of the most unprecedented characteristics of the aftermath of the 1994 genocide in Rwanda was the high proportion of unaccompanied children and orphans among the refugees. In response, some 28 unaccompanied children’s centres were established for the nearly 7000 children who were registered as unaccompanied. These received at least 20 litres of clean water per child per day, and a ration contributing 5880 kJ and 43 g protein was provided daily for each child aged one to six years and a ration contributing 5880 kJ and 43 g protein was provided daily for each child aged one to six years (1). While this special target group benefited from consistent nutrition and adequate clean water, the remaining refugee population experienced catastrophe characterised by epidemics of diarrhoeal diseases (initially cholera, followed by *shigella dysenteriae*), infectious diseases (malaria and meningitis) and malnutrition. As is standard practice in both human-made and natural disasters an initial assessment was carried out to evaluate the magnitude of the catastrophe and to provide data for decision making. In the case of the Rwandan refugees, the initial assessment was carried out by the Goma Epidemiology Group (2). This group of experienced public health assessors estimated that, within the first month of the crisis, approximately 50 000 refugees died, averaging a crude mortality rate of 35 per 10 000 per day. By the end of the second month, the crude mortality rate had declined to eight per 10 000 per day. The same report indicates that the main causes of death were diarrhoeal diseases, in particular cholera and dysentery and acute malnutrition in children under five years of age with an estimated rate of 23%.

Katale camp

Katale camp was situated 60 km north of Goma and sheltered 226 525 refugees of whom 31 714 were children aged between six and 59 months. More than 20 Non-Government Organisations (NGOs) provided medical and non-medical services to refugees who lived in this camp. However, the implementation of nutritional and health programs was not as smooth as these NGOs would have projected. The refugees resisted or refused to allow their identities to be established, and as a result some community leaders, who were later accused of participating in or steering the 1994 genocide, were inadvertently employed by NGOs in key strategic positions and were heavily involved in general food distribution. The presence of political and military leaders in this camp meant that NGOs’ efforts to ensure effective and equitable distribution of relief supplies such as food, drugs, shelter or cooking facilities were challenged and the extent to which these efforts successfully met their initial intended objectives was difficult to ascertain.

Despite these difficulties, public health programs showed an impact over time. The last nutritional survey carried out in November 1995 (3) had indicated that the global malnutrition prevalence had declined to 3.2% (95% CI 1.4, 6.9). As a consequence in April 1996 the United Nations High Commissioner for Refugees (UNHCR) decided to close the therapeutic and supplementary feeding centres and to integrate nutritional supplementation into the Maternal and Child Health program such that pregnant and lactating women and malnourished children could be screened and receive targetted nutritional supplements while remaining in their family environment. Severely malnourished children were transferred to the paediatric hospital and moderately malnourished children benefitted from a targeted special food distribution of a micronutrient-fortified blended food (based on cereals such as flours and grains, legumes, and oil seeds) and high protein biscuits. In order to examine whether the decision to close the feeding centres was justifiable, as well as to assess and document the overall nutritional situation in the camp we conducted a nutritional survey in May 1996, to examine the public health and nutritional situation of refugees in Katale camp after two years of nutritional and health interventions from 1994 to 1996.

Method

Choice of sampling method

Anthropometric data were collected on children aged between six and 59 months in the camp using a two-stage cluster sampling method from 28 May to 4 June 1996. This method is described in detail in Médecins Sans Frontières’ nutrition guidelines (4). This design is the approach most advocated in refugee camps given some important methodological constraints (4). Firstly, when refugees cross borders, they usually do so in disarray and panic which is exacerbated by the large size of the refugee population relative to the size of land available in host countries, as once in the host country the camp is most often built on the principle of ‘first come, first served’. As a consequence, camps tend to be structured in such a way that geographic units are generally not sufficiently well organised to allow for systematic sampling. Secondly, given that food and other benefits are rationed per person per day of stay in the camp, head of households tend to inflate the recorded size of their respective families to improve their distribution benefits, hence making it difficult for service providers to obtain the type of accurate registry of the refugee population which is a prerequisite for a random sampling approach.

These factors were exacerbated in the case of the Rwandan refugees in Zaire, and Katale camp in particular, as they were under pressure from political and military leaders to hide their leaders’ identities in order to avoid prosecution for crimes of genocide (the so-called ‘génocidaires’). The refugees initially refused any registration of identity and deliberately hampered census-taking. Although a register of sorts was finally established, many if not all refugees went under false names and children were frequently ‘adopted’ by other families on distribu-
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Sampling method and sampling interval

Four zones were identified in Katale camp. The UNHCR provided figures for the estimated population in each zone and its population of children aged six to 59 months was then estimated, assuming children aged six to 59 months to represent 14% of the total (usually in refugee situations in the third world, children under five years can represent up to 20% of the population, but prior demographic data had established the percentage in this age group in Katale camp). Subjects were selected for assessment, using a two-stage cluster sampling method. The first stage was the selection of 30 clusters, such that the number of clusters in each zone was proportional to the total number of children aged six to 59 months in that zone (use of 30 clusters is standard practice for nutritional surveys in refugee camps (4,5)). The second stage was the selection of households within each cluster as described below.

Selection of children within clusters and physical measurement

Locally trained nutritionists and community health workers collected the data. Training in how to weigh and measure the children was provided. These data collectors were then subdivided into seven groups. Three people were in each group: one supervisor and two anthropometric assistants. The group went to the centre of the zone, and then spun a bottle on the ground. The team supervisor counted and numbered all houses in the bottleneck direction from the centre to the border of the zone. A random number table was used to choose the first house to be visited in that zone. Suppose that after spinning the bottle, the supervisor counted 18 houses in the bottleneck direction from the centre to the border. Reading the random number table from top to bottom, the team supervisor closed his eyes and randomly pointed a pencil anywhere in the random number table. Then he opened his eyes to read the first two digits. If that number was over 18, the pencil was dragged down row-by-row reading the first two digits situated between 01 and 18. Assuming that that number was 13, therefore the household with number 13 was the first house to be visited. All children aged between six and 59 months living in that house were weighed and measured, and measles immunisation verified by reading immunisation cards presented by the child’s mother. A verbal recall of immunisation was not accepted, although it may well have been accurate. Families had difficulty maintaining paper records in tented accommodation, especially during the season of heavy rains.

The next household to be visited was the closest household to the initial surveyed household from right to left. This process continued until the number of children required for a cluster was reached (minimum number of children required for a cluster is the sample size divided by the minimum number of clusters required, that is: 430/30 = 14 children). If collectors reached the border of the zone being surveyed before reaching the number of children required for a cluster, they returned to the centre to choose another direction by spinning a bottle. They followed the same process as when choosing the first household to be visited. All eligible children within the age range in selected households were measured and weighed. In the case where an eligible child was absent, his or her location was established by interviewing the parents. The data collectors then went to the child’s identified location, whether at the feeding centre, hospital or school, to weigh and measure the child. If the child had died, then this was recorded together with the date the death occurred. That is why the response rate was by default 100%. This followed the standard procedure for nutritional surveys in refugee camps adopted in preceding nutrition assessments in Katale (4,5).

Data collection

Anthropometric data were recorded on the data sheet by the supervisor and the latter checked the accuracy of all data prior to its recording. Height was measured using the standard issue UNHCR measuring board, graduated to 0.1 cm accuracy. Children aged less than or equal to two years were measured lying down while children aged more than two years were measured standing upright. Weight was obtained using a 25 kg hanging spring scale, Salter type, graduated by 100 g. The scale was calibrated after each weighing. Measles immunisation status was confirmed only if the mother presented an immunisation card indicating the date on which the child was immunised. Crude mortality data and data on the quantity of water per person per day were obtained by reviewing the UNHCR’s weekly mortality data and health situation reports respectively, compiled by regional representatives. The examination of periodical reports of food basket monitoring was carried out to determine the trend of the general food distribution over the preceding six months.

Definition of malnutrition

Nutritional status was obtained by computing the weight-for-height (W/H), expressed as a percentage of the median and as a Z-score, using the National Centre Health Statistics/Center for Disease Control/WHO references (6). Global malnutrition was defined as a W/H less than 80% of the median or Z-score less than -2 and/or oedema while severe acute malnutrition was defined as a W/H less than 70% of the median or a Z-score less than -3 or oedema (4,7,8).

Sample size calculation

The sample size was obtained using the following formula (4):

\[ N = \frac{t^2 \times [P \times (1-P)]}{d^2} \]

\[ N = \text{sample size, } t = \text{parameter related to the error risk and is equal to 1.96 for an error risk of } 5\%, \text{ } P = \text{expected malnutrition prevalence, and } d = \text{absolute precision and for this evaluation we used a precision of } 3\%. \text{ Considering that the last nutritional survey indicated a malnutrition prevalence of } 3.2\%, \text{ we expected that the malnutrition prevalence had risen to } 5.3\% \text{ given that feeding centres had been closed and food distribution was not meeting minimal accepted standards. Hence, our sample size was: } N = 1.96^2 \times [0.053 \times 0.947)]/0.03^2 = 215. \]

Using a two-stage cluster sampling involves selecting people living next to each other and who may be similar in some respect. This leads to a loss of information, a situation that is less likely to occur if a systematic or random sampling method was used. To account for this design...
effect, the sample size was doubled and data were collected on 431 children.

Data analysis

Data were analysed using EPINUT, part of EPINFO package (Centers for Disease Control and Prevention, Atlanta, EPINFO, version 6.04a 1996). Weight-for-height index and proportions of malnourished and immunised children were computed. Mean daily energy content of the ration was obtained from retrospective review of food basket monitoring data over six months, covering the period from January to June 1996. The mean crude mortality rate was obtained by retrospectively reviewing the UNHCR’s weekly mortality data over three months covering the period from March to June 1996. Daily average litres of water per person were obtained by reviewing the water supply over a one-month period covering the month of May 1996. All 95% confidence intervals were adjusted for clustering within household.

Results

Nutritional status

An examination of age and sex distribution of our sample size indicates that 53.3% were boys and 46.6% girls and 48.9% of children aged between six and 29 months (Table 1). Malnutrition was most prevalent in the six to 29-months age group (Table 2) and at 6.2% was almost double the overall global acute malnutrition prevalence. When compared with the previous nutritional survey, the global acute malnutrition prevalence had increased by 0.3% but this increase was not statistically significant. Severe acute malnutrition prevalence decreased by 0.8% since 1995 (0.4%; 95% CI 0.1%, 3.1% versus 1.2%: 95% CI 0.2%–4% in 1995). It should be noted that it is the point estimate that is important in decision making and not the precision of the estimate.

Food ration and public health situation

Food supply

The general food ration, although conforming to the World Food Program minimum standards of adequacy in terms of variety (being composed of cereals, oil, legumes, blended and fortified cereal and legume mixes and salt), provided a mean of 6240 kJ (95% CI 5040, 7140 kJ) per person per day, thus meeting only 57% to 84% of the minimum energy requirements for an adult, and falling well short of the needs for sub groups with higher nutritional requirements such as pregnant and breastfeeding women and the sick. Measles immunisation coverage in children nine to 59 months was 88.6% (see Table 3).

Measles immunisation status

The measles immunisation coverage rate, excluding children aged between six and nine months, was 88.6% (95% CI: 83, 94.2); this rate increased to 95.6% (95% CI: 90.8, 98.3%) when the six to nine-months age group was included.

Table 1. Demographic characteristics of children assessed in Katale refugee camp

<table>
<thead>
<tr>
<th>Age group (in months)</th>
<th>Boys n (%)</th>
<th>Girls n (%)</th>
<th>Total n (%)</th>
<th>Sex ratio Boys/girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–17</td>
<td>58 (25.2)</td>
<td>46 (22.9)</td>
<td>104 (24.2)</td>
<td>1.26</td>
</tr>
<tr>
<td>18–29</td>
<td>55 (23.9)</td>
<td>52 (25.9)</td>
<td>107 (24.8)</td>
<td>1.06</td>
</tr>
<tr>
<td>30–41</td>
<td>43 (18.7)</td>
<td>36 (17.9)</td>
<td>79 (18.3)</td>
<td>1.19</td>
</tr>
<tr>
<td>42–53</td>
<td>33 (14.3)</td>
<td>38 (18.9)</td>
<td>71 (16.5)</td>
<td>0.87</td>
</tr>
<tr>
<td>54–59</td>
<td>41 (17.8)</td>
<td>29 (14.4)</td>
<td>70 (16.2)</td>
<td>1.41</td>
</tr>
<tr>
<td>Total</td>
<td>230 (53.4)</td>
<td>201 (46.6)</td>
<td>431 (100)</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Table 2. Nutritional status in Katale refugee camp

<table>
<thead>
<tr>
<th>Age group</th>
<th>Prevalence using % of median(a)</th>
<th>Prevalence using Z-score(a)</th>
<th>Ratio of prevalence estimate (Z-score: % median)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–29 months</td>
<td>3.3% (95% CI: 0.9%, 9.4%)</td>
<td>6.2% (95% CI: 3.4%, 10.6%)</td>
<td>1.9</td>
</tr>
<tr>
<td>Global acute malnutrition(b)</td>
<td>1/220</td>
<td>2/220</td>
<td>1.8</td>
</tr>
<tr>
<td>30–59 months</td>
<td>0.5% (95% CI: 0%, 2.9%)</td>
<td>0.9% (95% CI: 0.1%, 3.6%)</td>
<td>1.8</td>
</tr>
<tr>
<td>6–59 months</td>
<td>8/431</td>
<td>15/431</td>
<td>1.8</td>
</tr>
<tr>
<td>6–29 months</td>
<td>1.9% (95% CI: 0.5%, 5.0%)</td>
<td>3.5% (95% CI: 1.5%, 7.2%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Severe acute malnutrition(c)</td>
<td>0/220</td>
<td>1/220</td>
<td>-</td>
</tr>
<tr>
<td>30–59 months</td>
<td>0.5% (95% CI: 0%, 5.2%)</td>
<td>0.5% (95% CI: 0%, 5.2%)</td>
<td>2.0</td>
</tr>
<tr>
<td>6–59 months</td>
<td>0%</td>
<td>0.5% (95% CI: -0.1%, 2.9%)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1/431</td>
<td>2/431</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.2% (95% CI: 0.0%, 2.6%)</td>
<td>0.4% (95% CI: 0.1%, 3.1%)</td>
<td></td>
</tr>
</tbody>
</table>

(a) All 95% CI were adjusted for clustering within household.
(b) Global acute malnutrition refers to a weight-for-height index less than 80% of the median and/or bilateral oedema; a Z-score less than –2 and/or bilateral oedema.
(c) Severe acute malnutrition refers to weight-for-height index less than 70% of the median or bilateral oedema; or a Z-score less than –3 or bilateral oedema.
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Table 3. Public health situation in Katale refugee camp

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccinated against measles: 9–59 months</td>
<td>88.6% (95% CI: 83, 94.2%)</td>
</tr>
<tr>
<td>Vaccinated against measles: 6–59 months</td>
<td>95.6% (95% CI: 90.8, 98.3%)</td>
</tr>
<tr>
<td>Vaccinated against measles: 6–9 months</td>
<td>7.3% (95% CI: 5.7, 9.4%)</td>
</tr>
<tr>
<td>Not vaccinated against measles: 6–59 months</td>
<td>4.4% (95% CI: 2.6, 6.2%)</td>
</tr>
<tr>
<td>Crude mortality rate</td>
<td>0.3/10 000/day</td>
</tr>
<tr>
<td>General food ration (mean)</td>
<td>6240 kJ (95% CI: 5040–7140 kJ)</td>
</tr>
<tr>
<td>Water distribution (mean)</td>
<td>15 litres/person/day</td>
</tr>
</tbody>
</table>

(a) Although vaccination for measles is normally given at nine months of age in Africa, in refugee situations where infants are at high risk, children are vaccinated aged six months to provide some protection against measles. However, because they do not develop a sustained immune response at this age, they receive a repeat dose at nine months.

Discussion

Why target the six to 59-months age group?

In this study, we report the nutrition and health status of Rwandan refugee children in Katale refugee camp. It is common practice in refugee camps to survey children aged between six and 59 months and their nutritional status is taken to reflect the nutritional status of the overall refugee population from which the under-five-year-old group was selected (4,7,9). There are three schools of thought that have been put forward to justify such a decision (7). Firstly, there are internationally accepted guidelines for use in nutritional surveys to determine the age of a child (4,9). Therefore, the age was recorded directly from the immunisation card. This was available for 95.6% of children. Where this was absent, a calendar of events was used. In using the calendar of events, the mother was asked whether the child was born before, during or after recognisable major events pertinent to the population (occurring seasonally, annually or uniquely in a particular year) such as harvests, civil unrest and so on. Where this could not be established, the height criterion was applied, assuming that children to be surveyed are those whose height was greater than 65 centimetres and less than 110 centimetres (roughly equivalent to the range in children aged six to 59 months).

Mortality rate

The crude mortality rate was found to be 0.3 per ten thousand per day. The average mortality rate for children under five years of age was 0.76 per ten thousand per day, and thus double the rate of the general population.

Water supply and sanitation

Water sources were protected and chlorinated and refugees received a ration of 15 litres per person per day for their drinking, cooking, bathing and washing needs. Cholera outbreaks had been eradicated, and only isolated cases of shigellosis, meningitis and measles were reported through the active morbidity and mortality surveillance system. Public and familial pit latrines were available and adequate. Each refugee received 50 g of soap weekly.

Nutritional status

Our findings on the nutritional status are presented by contrasting the six to 29-months-old age group with the six to 59-months-old age group, expressed as a percentage of the median or Z-score. The reason for this is because research over time has shown that malnutrition is most prevalent in children aged less than three years (7). Hence, some surveys and interventions have been limited to this target group. This kind of trend has been shown to be more likely in stable refugee situations. However, in emergency refugee situations, this trend may not necessarily be true and it has been customary to include children aged between three and five years.

The findings indicate that the prevalence of malnutrition in the six to 29-months age group was almost sevenfold the malnutrition prevalence of the 30 to 59-months age group. While our study followed the trend found in stable refugee camps or situations of ‘chronic emergency’ as could perhaps have been predicted by the history of the Rwandan refugees in the region, in the literature there

Determining the child’s age

Given the generally low level of educational attainment (in particular, literacy and numeracy) of women in refugee camps, it has always been a challenge to obtain the correct age of eligible children during nutritional surveys. In this survey, eligible children were selected using internationally accepted guidelines for use in nutritional surveys to determine the age of a child (4,9). Therefore, the age was recorded directly from the immunisation card. This was available for 95.6% of children. Where this was absent, a calendar of events was used. In using the calendar of events, the mother was asked whether the child was born before, during or after recognisable major events pertinent to the population (occurring seasonally, annually or uniquely in a particular year) such as harvests, civil unrest and so on. Where this could not be established, the height criterion was applied, assuming that children to be surveyed are those whose height was greater than 65 centimetres and less than 110 centimetres (roughly equivalent to the range in children aged six to 59 months). However, there are a certain number of children whose age on the immunisation card indicated they were eligible for the survey but whose height was well above 110 centimetres. These children were still surveyed and were more likely to fall into the 54 to 59-months age group, contributing to the relatively large number of children in this age group. Other reasons for this bulge in the demographic distribution are that the older children surveyed were also the oldest at the time of the exodus from Rwanda and therefore likely to have been the least vulnerable to subsequent disease. Additionally, although the fertility rate was traditionally high in Rwanda (average number of pregnancies per woman was nine), there was a marked decline under camp conditions, which would be reflected in a reduced cohort of children under two years.
have been sporadic reports of malnutrition being most prevalent in the three- to four-year-old age group (7).

Public health situation

Overall, the public health and nutrition situation in Katale camp looked very promising. Referral of severely malnourished children to paediatric hospital inpatient facilities and admission of moderately malnourished children to the dry supplementary feeding centres, that had been integrated into the Maternal and Child Health program, were made using the percentage of median weight-for-height. However, our findings indicate that the Z-score predicted a malnutrition prevalence that was almost twice that predicted by the percentage of median. If the Z-score prediction was in fact closer to the true prevalence there was a very real risk that malnourished children who needed to be admitted to paediatrics and dry supplementary feeding centres for nutritional rehabilitation were likely to be misclassified or missed entirely. Considering that malnutrition prevalence is used to plan and calculate decision-making denied a sizeable fraction of at-risk children access to nutritional interventions.

It is common practice to assess measles immunisation status as part of the nutritional survey in refugee camps. This is because measles predisposes children to the risk of vitamin A deficiency and aggravates malnutrition, especially Kwashiorkor, in children under five years of age (4). It is well documented that the risk of vitamin A deficiency increases after an outbreak of measles (7,11); and this is especially true for children under five years of age who have received vitamin A and the coverage rate was by default identical. It should also be noted that children attending the Maternal and Child Health centres were routinely screened for clinical signs of vitamin A deficiency, with no cases reported.

Food quality and food distribution

The general food ration was nutritionally unbalanced and inequitably distributed. The ration provided bulk in the form of cereals (maize) but meagre quantities of the nutritionally more valuable corn soya blend. Computing the proportion of energy from protein and fat provided by the theoretical ration showed protein composed 8.7% (minimum required in refugee camps is 10%) and fat 35.3% (minimum required in refugee camps is at least 17%). However, this theoretical ration, although itself inadequate, did not reach all beneficiaries within households. There were regular supply problems, and lack of important constituents such as salt and oil at times. In addition, there were inequities in the food distribution process due to food being siphoned off by camp leaders for military purposes at various levels, and food basket monitoring suggested irregularities in the distribution at the individual family level. Even those who received their ration may not have consumed it, with items of higher monetary value such as the corn soya blend, or unfamiliar foods such as UNIMIX being traded for other goods, and hence much of the quantity of corn soya blend received through general food distribution ended up in local markets for the non-refugee population. In emergencies, blended and fortified foods such as corn soya blend or wheat soya blend, UNIMIX, BP-5 compact food (high protein biscuits) and dried skim milk constitute a good source of protein and micronutrients.

For the Rwandan refugees in Katale camp, the typical general food ration was composed of cereals (e.g. maize grains), vegetable oil, legumes (e.g. beans), salt and blended and fortified foods (e.g. corn soya blend or BP-5). However, an analysis of this general food ration revealed that the ration was extremely deficient in vitamins A and C and not only was the quantity of corn soya blend provided inadequate compared to the theoretical quantity, but this food also contained an insufficient quantity of iron (14). This raised the question whether refugees living in the Katale camp were free from micronutrient deficiencies. Nevertheless, no micronutrient deficiency outbreaks were reported. This may have been due to the refugees having some access to fruit and vegetables through their networks with the host population given their cultural and nutritional similarities. Furthermore, fruit and vegetables were produced in abundance in the Rutshuru region and Katale camp environs. To access these food commodities, refugees carried out agricultural labour for the host population for money to buy extra commodities, not provided by the humanitarian relief programs. They sold part of their general food ration, especially those food items that...
were unfamiliar to them, they stole and sold food aid and drugs, gained employment with NGOs, hunted and gathered wild food, and thus had developed sophisticated coping mechanisms to deal with food shortages or unfamiliar food items. However, in the six months prior to the survey, the refugees had had economic restrictions imposed in the camp and region, limiting ability to live or work outside the camp, trade or buy in the local markets, resulting in an inability to supplement their diet.

Conclusion

Public health interventions in Katale camp from 1994 to 1996 had reduced mortality and morbidity rates dramatically, and yet this was not reflected in the malnutrition rates for children under five years of age. This had remained stable after an initial fall despite two years of nutritional intervention. Given the discrepancy between percentage of median and Z-score in predicting the prevalence of malnutrition, and the attendant risk that malnutrition rates had not fallen because malnourished children were not being identified, it was recommended that the decision for admitting children to supplementary feeding centres or referring severely malnourished children to hospital be based on Z-score and not the percentage of median of weight-for-height index. It was envisaged that health workers and nutritionists involved in selecting malnourished children would be trained to acquaint them with the concept of Z-score and how to calculate and interpret it. To further improve the nutritional situation in Katale camp, it was recommended that targeted supplementary feeding remain integrated within the Maternal and Child Health program to accommodate the nutritional needs of moderately malnourished children.

Findings from this study supported the notion of referring severely malnourished children to the paediatric hospital for medical treatment and nutritional rehabilitation.

To prevent the deterioration of the nutritional status of the Rwandan refugees it was recommended that the general food ration, especially the source of protein and blended food, be improved and distribution more closely supervised, and that the measles immunisation coverage rate be maintained and even improved upon.

Postscript

Katale camp continued in existence for another few months until the refugees were forced to move by a military attack orchestrated by the Rwandan government in October 1996. The refugees abandoned the Zaïrean camps en masse, and the large majority returned to Rwanda on foot, with a minority heading into the jungle in Zaïre. Just as in the exodus following the genocide, the most medically and nutritionally vulnerable may not have survived the journey.

Zaire was officially renamed the Democratic Republic of Congo in 1998. Most recently, in January 2002, Goma attracted world attention again when Mount Nyiragongo volcano, situated six miles north-east of Goma and closest to the former Mugunga refugee camp, erupted. Half a million local people fled en masse; 14 000 households were destroyed; and 30% to 40% of the city including the cathedral, airport, residential and business centres were destroyed. One hundred thousand people remain homeless (15–17).

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References