An Area at War: Alarming Malnutrition Status and its Predictors among Children Aged 6-60 Months Old in Kokang, Myanmar

Ai Zhao1, Qiyan Xiao1, HongChong Gao2, Shuangjie Cao2, Mingyu Zhang3, Naing Naing Win4 and YuMei Zhang5*

Abstract

Aim: Myanmar is a populous and impoverished country with military conflicts for over 40 years and Kokang is one of the most turbulent regions. Malnutrition is a major health problem in this area, however researches are limited. This study aims to evaluate the malnutrition condition of children in Kokang, Myanmar and the factors associated with malnutrition.

Methods: Data were obtained from 123 children aged from 6 to 60 months. Anthropometrical assessment was performed and validated questionnaires were used to collect socioeconomic and demographic data.

Results: Among the children enrolled in this study, 42.5% were found to be stunting, 22.5% were underweight, 8.3% were wasting, 8.3% were thin, 5.9% had a small head circumference, and 3.3% were wasting with amid-upper arm circumference <12.5 cm. Drinking spring or river water (OR=7.11, 95% CI 2.46–20.52) was a predictor of stunting and low family annual income contributed to underweight (OR=8.95, 95% CI 1.63–49.11) in the regression model. Predictors of wasting included age and length of exclusive breastfeeding.

Conclusion: This study illustrates the alarming local prevalence of childhood malnutrition and the associated predictors, which require a multipronged approach to find a solution.

Keywords

Malnutrition; Child; Myanmar

Introduction

Malnutrition is a major health problem in developing countries. Children who suffer from malnutrition are at greater risk of severe morbidity and mortality, especially when they are under 5 years old [1,2]. Many factors have been reported to contribute to malnutrition, including nutrient intake, water supply, education status, family annual income and public sanitation conditions, most of which are linked to poverty [3-6].

Myanmar is a populous and impoverished country that has experienced military conflicts for over 40 years and Kokang is one of the most turbulent regions. Kokang was ruled by the Communist Party of Burma, and after the dissolution of that party in 1989, it became a special region of Myanmar under the control of the Myanmar Nationalities Democratic Alliance Army (MNDAA). Armed conflicts between the MNDAA and government troops occurred in 2009 and 2015, and as a result, this region suffered from remoteness, civil conflicts and low socioeconomic development [7]. Previous studies indicated that infectious diseases such as tuberculosis, malaria and parasitic infection were serious problems in Myanmar [8,9]. According to the Nutrition Landscape Information System (NLiS) Country Profile: Myanmar, in 2010, 35.1% of children under five were stunting, 7.9% were wasting and 22.6% were underweight [10]. However, malnutrition among children in the Kokang area has not been evaluated yet. In addition, only a few researches have focused on predictors of malnutrition in Kokang. This survey aims to evaluate the prevalence of malnutrition among children (aged 6-60 months) and identify the main factors contributing to malnutrition in rural areas of Kokang.

Materials and Methods

Participants

From June to October 2014, a cross-sectional study was conducted in Kokang, a self-administered zone of Myanmar. Nine villages were selected with convenience sampling. A total of 123 children (aged 6-60 months) were recruited to participate in the survey with cluster sampling (the population of children aged between 6 and 60 months in the investigated area was estimated to be around 150). Feces samples were obtained from 29 children who defecated on the day of investigation for a parasitic infection test.

Data collection

Anthropometric measurements comprising height, weight, head circumference (HC) and mid-upper arm circumference (MUAC) were collected. The Infant/Child Shorrboard (Infant/Child Shorrboard YSZ-1, Keda Medical Instruments Co. Ltd., Shanghai, China) was used to measure both child stature and recumbent infant length (if the child was <85 cm). Weight was measured using a portable scale (Portable Scale, Xinman Medical Instruments Co. Ltd., Shanghai, China) with infants'/children’s clothing, shoes and diapers removed (measured to the nearest 0.1 kg). MUAC was measured at the middle of the left arm using single-slotted insertion tapes (10-100 cm, Zhejiang, LeChen Co. Ltd., China). Malnutrition was assessed by indicators of development. Mid-upper arm circumference (MUAC), head circumference Z score (HCZ), weight-for-age ratio Z score (WAZ), height-for-age ratio Z score (HAZ), BMI-for-age Z score (BAZ) and weight-for-height ratio (WHZ) were included. In accordance with the WHO’s Child Growth Standards 2006, underweight, stunting, thin and wasting were defined as WAZ <-2, HAZ <-2, BAZ<-2 and WHZ <-2, respectively. HCZ<-2 was defined as small HC [11]. Meanwhile, MUAC less than 12.5 cm was also considered to be wasting [12]. Stool samples were collected and direct wet mount microscopic examinations were performed to identify Ascaris lumbricoides. Validated questionnaires were administered to collect demographic and socioeconomic information.
and self-reported health status within 3 months. Information about the frequency of intake of fish, eggs, meat and milk was also obtained. All measurements and examinations involved in this survey were conducted by trained staff from Health Poverty Action (HPA), an international NGO that has been working on promoting health since its foundation in 1984 [13].

**Standard protocol approvals, registrations and patient consent**

The study was conducted in accordance with the Declaration of Helsinki and approved by the Kokang government. All participants were informed of the procedures and purpose of the study and written, informed consents were obtained.

**Data analysis**

Measurements were converted into z scores using WHO Anthro (predictive analytics software and solutions) software version 20.0 (International Business Machines Corporation, New York, USA) was used to carry out the analysis. Variables are presented as mean (SD) or frequencies. The normality of distributions was evaluated before analysis. One-way ANOVA and a Chi-square test were performed to determine predictors of stunting, wasting and underweight. Logistic regression (with the backwards Wald method) was used to obtain odds ratios and 95% confidence intervals (95%CI) to estimate the associations between malnutrition and its predictors. In the multivariate analysis, only socioeconomic factors and self-reported health-related status, which were found to be associated with stunting in the single analysis, were entered into the regression model. Non-significant variables were removed from the final model. A P value <0.05 is considered statistically significantly different.

**Results**

**Characteristics of children in this survey**

In this study, data of 123 children between 6 and 60 months old were collected. According to WHO Anthro outlier parameters (z scores over +5 or under -5 are outliers), three extreme samples were excluded, leaving 71 males and 49 females included in the final data analysis.

The mean age for males and females was 26.8 (16.6) and 29.9 (17.7) months, respectively. Among the participants, 85.2% were ethnic Kokang and others were ethnic Deang.

**Prevalence of malnutrition**

Among the children in this study, 42.5% were stunting, 22.5% were underweight, 8.3% were wasting (defined by WHZ < -2), 8.3% were thin, 5.9% had a small HC and 3.3% were wasting (defined by MUAC<12.5 cm). Taking all the above into consideration, 59.2% of the children were affected by atleast one type of malnutrition.

**Predictors of malnutrition**

**Demographic factors:** The tendency of HAZ, WAZ and WHZ with age was shown (Figure 1). Children aged 37–60 months had inferior WAZ and WHZ to those aged 6–24 months (P<0.005 and 0.004, respectively). Malnutrition prevalence was also categorized by gender; however, no significant difference was found (P=0.757, 0.467, 0.368, for stunting, wasting and underweight, respectively).

**Socioeconomic factors:** Significant predictors of stunting include family annual income, water source and toilet condition. Family annual income and water source were also found to be associated with underweight. However, socioeconomic factors were not found to be associated with wasting. Results are shown in Table 1.

**Disease and self-reported health-related status:** Based on local medical records, malaria or AIDS and HIV infection were not reported. Some 4.4% of children had suffered from measles in the previous 3 months. The self-reported health-related status was also collected and analyzed. No children were found to suffer from bone fracture, poor darkness adaptation or bluntness. A total of 5.2% had been appeared to be indifference, 4.2% experienced nose or gingival bleeding, 38.3% suffered from diarrhea and 45.0% suffered from fever within 3 months. Overall, 56.7% of the children suffered from at least one kind of symptom. Twenty-nine children were examined for Ascaris lumbricoides, and 27.6% of the children were affected. Among all the predictors, only diarrhoea was found to be related to stunting (P=0.014).

**Food intake:** Among children over 12 months, it was reported that 29.3% of them never had fish, and 21.7% of them never had milk. Only 4.3%, 27.3%, 47.8% and 80.4% of them ate fish, milk, egg and meat once a week or more. Among all participants, 45.7% received a nutrition package (the nutrition package contained macronutrients and micronutrients) and 13.0% received a food supply. Notably, 81.1% of the nutrition packages and all of the food supplies were distributed to children aged 6-24 months. In addition, 90.8% of the children received exclusive breastfeeding for over 6 months. Neither the intake of fish, meat and eggs nor the reception of a nutrition package was associated with stunting, underweight and wasting (P all >0.05). In addition, children who received exclusive breastfeeding for over 6 months were at risk of wasting (P=0.049).

**Logistic regression analysis**

In accordance with the single factor analysis, family annual income, the source of water, toilet condition and occurrence of diarrhoea were entered into the logistic regression model for stunting while family annual income and the source of water were included for underweight. Finally, drinking spring or river water was found to be associated with stunting and low family annual income is related to underweight (Table 2).

**Discussion**

**Prevalence of malnutrition**

This study demonstrated the high prevalence of malnutrition in Kokang, Myanmar. Over half of the children were suffering from malnutrition and facing a high risk of morbidity and mortality [14-16]. The prevalence of malnutrition is slightly above the national average according to the NLiS Country Profile, which might be the result of frequent military conflicts [9]. In addition, this prevalence is higher than in some other places with frequent conflicts that were classified by the WHO as having a “very high” prevalence of malnutrition in children (the malnutrition rate is 29.2% in Chiapas, Mexico and 57.3% in Angola) [17,18]. According to previous studies, conflicts may decrease the food supply and increase the chance of developing infective diseases [19]. In addition, social tensions may disrupt the intra-community cooperation and thus interfere with the cultivation and marketing of foods [19]. Maternal stress may reduce breast milk production [19,20]. All these effects may have a negative influence on the nutrition status of children.
Predictors associated with stunting, wasting and underweight

Demographic predictors: Age-wise distribution of WAZ and HAZ showed a roughly downward shift of curves throughout the age range of 6-60 months. We infer that one of the possible explanations for the malnutrition deterioration with age is that the adverse impacts accumulated as the children grew up. In addition, due to limited sources and the knowledge that anaemia is more prevalent in children aged 6-24 months, the humanity aid, including the provision of a nutrition package by the HPA, was only implemented for children aged 6-24 months. And compared with them, children aged 37-60 months showed a higher risk of wasting and underweight. This result demonstrated the protective effect of nutrition intervention; however, it also reminded us that the nutrition intervention should be continued throughout the whole childhood.

Socioeconomic and self-reported health-related status: In univariate analysis, family annual income, water source, toilet sanitation and diarrhoea were found to contribute to stunting; family annual income and water source were related to underweight; and no socioeconomic predictors were reported to affect wasting status. This may be due to the fact that socioeconomic factors are more closely

### Table 1: The association between sociodemographic characters and malnutrition in single-factor analysis [N, Mean (SD)].

<table>
<thead>
<tr>
<th>Variables</th>
<th>Stunting</th>
<th>Wasting</th>
<th>Underweight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>P value</td>
</tr>
<tr>
<td>Family income (USD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(annual income per capital)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>80-160</td>
<td>29</td>
<td>26</td>
<td>0.023</td>
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<tr>
<td>160-480</td>
<td>5</td>
<td>9</td>
<td>0.067</td>
</tr>
<tr>
<td>&gt;480</td>
<td>9</td>
<td>23</td>
<td>0.181</td>
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<tr>
<td>Family population</td>
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<td></td>
<td>0.341</td>
</tr>
<tr>
<td>Mean (SD)</td>
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<td></td>
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<tr>
<td>7.3 (2.3)</td>
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<td>0.001</td>
</tr>
<tr>
<td>7.9 (2.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.4 (3.5)</td>
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</tr>
<tr>
<td>7.6 (2.4)</td>
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<td></td>
<td></td>
</tr>
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<td>7.3 (2.0)</td>
<td>0.034</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>7.8 (2.6)</td>
<td></td>
<td></td>
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<tr>
<td>1st birth-rate</td>
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</tr>
<tr>
<td>Spring or river water</td>
<td>24</td>
<td>12</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note: *P* value for trend
One-way ANOVA, the rest variables were analyzed by χ² test.
Total number of the participants is 123. Because of the missing information, not all the items add up to 123 children.

Figure 1: Tendency of WHZ, WAZ and HAZ with age (*indicate statistically significance).
related to stunting than wasting or underweight, which is supported by previous studies [21]. HAZ is usually compromised following a period of chronic malnutrition while WHZ is an indicator of short-term nutritional compromise [18]. This phenomenon may also explain the weak effect on WHZ of food supply and nutrition package intervention programs.

In the multiple-factor analysis, children who drank spring or river water were found to be at higher risk of stunting. According to previous researches, drinking spring or river water is a risk factor for parasitic infection [22] and microbes and parasites may account for diarrhoea and malnutrition status [23,24]. However, in our examination of Ascaris lumbricoides, water resource seemed to make no significant contribution (P=0.109), so the increased risk may be ascribed to other parasites.

In addition, children with low family annual income were found to be at risk of underweight in multiple-factor analysis. This result is similar to a previous study in Ghana [25]. Low income leads to insufficient food intake, greater exposure to infections and a lack of access to basic health services, which all contribute to malnutrition [25].

It is worth noting that all the risk factors: family annual income, toilet sanitation, the source of water and diarrhoea, are all related to poverty. And as a result of malnutrition, children will suffer from increased risk of infection and delayed cognitive development, leading to low adult incomes, and thereby causing intergenerational transmission of poverty [26]. All these results indicate that the socio-environmental issues that are related to malnutrition need to be solved urgently.

Food intake: It is recommended by the WHO that breastfeeding should last for as long as 6 months, and after that complementary food is needed since milk is no longer enough to meet the nutritional needs [27]. Our research showed that prolonged exclusive breastfeeding contributed to wasting. Thus, more education on feeding practice should be recommended. And according to our food intake data, there was a food shortage in this region, and this might lead to insufficient intake of both macronutrients and micronutrients, which are important for the growth of children.

Limitations

This is a cross-sectional survey, so selection bias is inevitable. Recall bias might exist. Also, since working conditions were limited, stool sample tests were not conducted for all the children, and only one kind of parasite, Ascaris lumbricoides, was tested. And parasites in water were not tested. However, according to the WHO country profile, the prevalence of parasite infection in Myanmar was roughly 20% in 2013 [10]. Therefore, it is necessary to test parasite level in water and study the relationship between the parasite level in water and the prevalence of children’s malnutrition.

Conclusions and Recommendations

This study illustrates the local prevalence of childhood malnutrition in Kokang. The results show that water source is a predictor of stunting. Predictors of wasting include age and exclusive breast feeding time, while age and family annual income contribute to underweight.

Based on the results of this study, some possible suggestions to address the malnutrition problem are listed below.

Control water resources. Provide access to healthy water resources to prevent children being exposed to a higher risk of parasitic infection caused by unsanitary water.

Improving basic sanitation, such as latrines, is essential for children’s health by preventing diseases from spreading.

Promote nutrition status by providing a sustained food supply and nutrition packages for children.

Acknowledgements

We are very grateful to the participants and HPA staff for their help. In particular, we would like to thank Mr. Li Bo for the sacrifice he made. Mr. Li Bo was a regional representative of the HPA in Kokang, Myanmar. In 2015, as the conflict broke out, he still retained his position and sacrificed his life in an accident. We express our deepest condolences to his family and heartfelt gratitude for his dedication to promoting health in Kokang.

References

27. WHO (2013) WHO recommendations on postnatal care of the mother and newborn.