ANEMIA AMONG LACTATING MOTHERS IN KOKANG, MYANMAR

Ai Zhao[1,a], ShuangJie Cao[2,a], HongChong Gao[3], QiYan Xiao[4], NaingNaing Win[5], YuMei Zhang[6]

[1]Department of Social Science and Health Education, School of Public Health, Peking University Health Science Center, Beijing; [2]Peking University First Hospital, Peking University Health Science Center, Beijing; [3]School of Basic Medical Sciences, Capital Medical University, Beijing; [4]Peking University Third Hospital, Peking University Health Science Center, Beijing, PR China; [5]Health Poverty Action Eastern Asia Programme Office, Kokang, Myanmar; [6]Department of Nutrition and Food Hygiene, School of Public Health, Peking University Health Science Center, Beijing Key Laboratory of Toxicological Research and Risk Assessment for Food Safety, Beijing, PR China

Abstract. Anemia is an important public health problem among lactating mothers in the developing countries. The aim of the study was to determine the prevalence of anemia in lactating mothers in Kokang, Myanmar and its associated risk factors. We conducted a cross sectional study of 65 lactating mothers during June-October 2014. Each participant filled out a questionnaire asking about diet, source of drinking water, health status, socioeconomic and demographic factors. Each participant was also evaluated anthropometrically and had blood taken to determine their hemoglobin and their iron, copper, zinc, calcium, and magnesium levels. The prevalence rate of anemia (hemoglobin 81-120 g/l) in study subjects was 73.8%, and 10.8% had severe anemia (hemoglobin ≤ 80 g/l). Factors of malnutrition (mid-upper arm circumference < 23.5 cm, $p = 0.013$), iron deficiency (serum iron concentration < 6.6 mmol/l, $p = 0.008$), and source of drinking water ($p = 0.031$) were related to anemia. Fifty-six point three percent of women with anemia had a low serum iron level. Anemia was common among study subjects in Kokang. Since a large portion of women in our study with anemia had a low serum iron level, we conclude the major cause of anemia in our study was iron deficiency.

Keywords: anemia, iron deficiency, lactating mothers, Kokang, Myanmar

INTRODUCTION

Anemia is one of the most common nutritional problems world-wide (WHO, 2004). It affects about half a billion women of reproductive age worldwide; in 2011, an estimated 29% of non-pregnant women (496 million) and 38% of pregnant women (32.4 million) aged 15-49 years were anemic (WHO, 2014a). Anemia is common in Myanmar, particularly among the ethnic minorities in the eastern provinces, such as Shan State (Zhao *et al*, 2014). Myanmar is a populous developing country in

Correspondence: Prof YuMei Zhang, Peking University Health Science Center, 38 Xueyuan Road, Haidian District, Beijing, PR China.
Tel +86 010 82802502
E-mail: zhangyumei111@gmail.com
[a]Joint first authors.

Southeast Asia, with a history of turmoil until 2011 (Low *et al*, 2014; Loyer *et al*, 2014); however, conflict broke out again in Kokang in 2015. Myanmar has one of the world's poorest functioning health-care systems, and has some of the poorest health indicators (under-five mortality: 104/1,000) in Southeast Asia (WHO, 2000; UNICEF, 2008). Lactating mothers are susceptible to malnutrition and anemia.

Anemia is a condition in which the number of red blood cells is insufficient to meet the body's physiological needs or the hemoglobin concentration falls below an established cut-off value, consequently impairing the capacity of the blood to transport oxygen (WHO, 2011, 2014b). The consequences of anemia include adversely affected cognitive and motor development, fatigue, dizziness, lethargy and impairing physical capacity and productivity (Crawley, 2004; Jain *et al*, 2013; Stevens *et al*, 2013). Apart from iron deficiency, infectious diseases, such as malaria, hookworm infections and schistosomiasis, nutritional deficiencies, such as folate and vitamins B_{12}, C and A deficiencies and inherited conditions, such as thalassemia and glucose-6-phosphate dehydrogenase deficiency can all cause anemia (WHO, 2001). Rakesh *et al* (2014) found the prevalence of postpartum anemia to be 50% to 80%. We conducted the study to determine the prevalence of anemia among lactating mothers in Kokang, Myanmar and identify some factors associated with anemia.

MATERIALS AND METHODS

Participants

We conducted this cross sectional study among lactating women from 16 villages in Kokang, Myanmar during June-October, 2014. Subjects were selected by cluster convenience sampling. All the women who gave birth to a baby within 3 years and still nursing were informed of our study by local health staff (around 90 women were qualified and informed). Finally, 65 women voluntary participated in the study.

Data collection

Height, weight and mid-upper arm circumference (MUAC) were measured for each participant. The body mass index (BMI) was calculated from the weight and height (kg/m^2). A BMI < 18.5 kg/m^2 was defined as underweight (WHO, 2014b). The MUAC was measured at the middle of the upper left arm using a single-slotted insertion tape (LeCheng 10-100 cm, LeChen, Zhejiang, China). A MUAC < 23.5 cm was defined as reflecting malnutrition (WHO, 1995).

A finger-prick blood sample was obtained to determine hemoglobin (Hb) level using the Hemocue Hb 201^+ (Hemocue, Angelholm, Sweden). A Hb 81-120 g/l and ≤ 80 g/l were defined as anemia and severe anemia, respectively (WHO, 2011). Iron, copper, zinc, calcium and, magnesium levels were tested using flame atomic absorption spectrometry. Iron, copper, zinc, calcium and magnesium deficiencies are defined as serum concentration < 6.6 mmol/l, 11.8 μmol/l, 76.5 μmol/l, 1.55 mmol/l and 1.12 mmol/l, respectively.

Each subject completed a standardized questionnaire asking for demographic and socioeconomic information, self-reported health status, including specific signs and symptoms during the previous three months. The questionnaire also asked about food intake frequencies during the previous week of beans, eggs, meat and milk, foods containing iron and protein.

Statistical analyses

Statistical analyses were conducted using SPSS version 20.0 (IBM, Armonk, NY). Descriptive statistics were performed for all variables. The independent-samples *t*-test and Mann-Whitney test were used for numerical variables. Normality of distribution was evaluated using the Kolmogorov-Smirnov test. The chi-square test was conducted using a 95% level to determine significance. Odds ratios (OR) and 95% confidence intervals (CI) were calculated to measure the strength of association between potential factors and anemia.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and approved by Kokang government. All participants were informed of the procedures and purpose of the study and gave written informed consent prior to participation.

RESULTS

Prevalence of anemia

The mean age of the participants was 27.9 ± 7.4 years (range = 17-47 years). The overall prevalence of anemia was 73.8%. The mean Hb level was 106.7 ± 20.9 g/l. Severe anemia was found in 10.8% of participants. There was no significant difference in mean age between the anemic and non-anemic women ($p = 0.738$).

Health status

Seventeen point two percent of participants were underweight (BMI < 18.5 kg/m^2), 22.2% were malnourished (MUAC < 23.5 cm) and 19.4% had received a nutritional package or food supplements.

The self-reported health related symptoms among participants during the previous three months included: unexplained fever (30.2%), diarrhea (17.5%), poor vision in the dark (10.3%) and nose or gingival bleeding (13.8%). No women had a history of malaria during the previous three months according to the records of the Health Poverty Action (HPA), a local nongovernment organization working on malaria control.

Fifty-six point three percent of women with anemia had a low serum iron level. The mean serum iron level among the anemic women was significantly lower than that among the non-anemic women ($p = 0.007$). The results of the independent-samples *t*-test and Mann-Whitney test are shown in Table 1. Iron deficiency (serum iron concentration < 6.6 mmol/l, $p = 0.008$), malnutrition (defined by a MUAC < 23.5 cm) was significantly associated with anemia ($p = 0.013$). Having a history of receiving a nutritional package, the self-reported health status of the participants and the trace elements (copper, zinc, calcium and magnesium) deficiencies were not significantly associated with anemia ($p > 0.05$).

The frequencies of intake of beans ($p = 0.562$), eggs ($p = 0.681$), meat ($p = 0.961$) and milk ($p = 1.000$), as shown in Fig 1, were not significantly associated with anemia.

Sociodemographic characteristics and anemia

Ninety-five point three percent of participants were from Kokang and the rest were from Deang. Eighty-five point five percent of participants came from a family with more than 5 members. Sixty point six percent had low yearly income below USD160. Sixty-seven point seven percent of participants had no primary education. Sixty-six point two percent of participants had a parity of ≥ 3, 12.3% had a history of dystocia with delivery, 86.2% had given birth at home without a

Table 1
Comparison of nutritional factors between anemic and non-anemic women.

Characteristics	Mean ± SD or median (Q25,Q75)		*F* or *Z*	*p*-value
	Anemic women	Non-anemic women		
BMI (kg/m^2)[b]	20.77 ± 3.24	22.52 ± 3.15	0.182	NS
MUAC (cm)[a]	25.00 (23.00,27.50)	26.00 (24.25,28.75)	-1.562	NS
Iron (mmol/l)[b]	7.25 ± 0.97	8.15 ±0.63	3.487	0.007
Zinc (μmol/l)[a]	101.06 (87.21,123.50)	102.19 (92.88,120.45)	-0.088	NS
Copper (μmol/l)[b]	18.72 ± 4.07	18.01 ± 2.92	1.737	NS
Calcium (mmol/l)[a]	1.75 (1.62,2.12)	1.69 (1.62,1.77)	-1.69	NS
Magnesium(mmol/l)[b]	1.47 ± 0.21	1.49 ± 0.12	1.449	NS

[a]Mann-Whitney test, [b]Independent-samples *t*-test. NS, no significance; BMI, body mass index; MUAC, mid-upper arm circumference.

Table 2
Association of variable with anemia.

Characteristics	Anemia[a]	No anemia	Chi-square *p*-value
Source of drinking water	48	17	0.031
Spring or river	19	2	
Sump or well	29	15	
Annual family income (in US dollars)	22	11	NS[b]
<160	15	5	
≥160	7	6	
Number of family members[c]	46	16	NS
3-5	7	2	
>5	39	14	
Maternal education[d]	46	16	NS
Uneducated	32	10	
Primary education	14	6	
Parity	48	17	NS
1-2	17	5	
>2	31	12	
Prenatal care	48	17	NS
Yes	17	4	
No	31	13	
Delivery place	48	17	NS
Home without a midwife	41	15	
Hospital or home with a midwife	7	2	

[a]Anemia was defined as a hemoglobin < 120 g/l. [b]NS, no significance ($p > 0.05$). [c]No family with less than 3 members. [d]No participants received education higher than primary education.

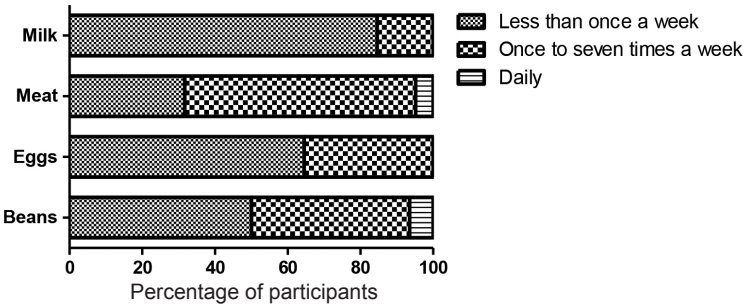

Fig 1–Frequency consumption of beans, eggs, meat and milk.

midwife and 67.7% had no prenatal care. Family income, number of family members, gravida, parity, maternal education, history of prenatal care and delivery place were not significantly associated with anemia. Drinking spring or river water was associated with anemia (p = 0.031, OR = 5.089; 95%CI: 1.042-24.863) (Table 2).

DISCUSSION

Anemia is a common problem in both the developed and the developing world. In 2001 the WHO estimated the prevalences of anemia among reproductive age women to be: 88% of pregnant women and 74% of non-pregnant women in India, 50% of pregnant women and 40% of non-pregnant women in Africa and 40% of pregnant women and 30% of non-pregnant women in Latin America and the Caribbean (WHO, 2001). The prevalence of anemia among lactating mothers in our study was high. Since a large portion of women in our study with anemia had a low serum iron level, we conclude the major cause of anemia in our study was iron deficiency.

In our study malnutrition (defined by a MUAC < 23.5 cm) and iron deficiency were closely associated with anemia. Iron deficiency is probably the most important cause of nutritional anemia (Dijkhuizen *et al*, 2001). Few participants in our study consumed iron rich foods daily, such as meat, eggs and soybeans. Not consuming iron regularly in the postpartum period is a risk factor for postpartum anemia; this period is characterized by increased erythropoiesis but iron stores may be depleted during the pregnancy and the increased needs during lactation result in insufficiency and anemia (Rakesh *et al*, 2014). One study found zinc deficiency was associated with anemia and can occur concurrently with iron deficiency (Stuetz *et al*, 2012). In our study we found no association between zinc deficiency and anemia. In our study some of the participants were underweight or malnourished and had poor low light vision suggesting vitamin A deficiency (WHO, 2014c). Vitamin A deficiency has been associated with anemia (Dijkhuizen *et al*, 2001). Many of our study participants had inadequate nutrition, which is important since the nutritional state of the mother can influence the nutritional content of breast milk and thus affect the nutritional state of the infant (Nakamori *et al*, 2009).

The Ministry of Health of Myanmar, reported the prevalence of malaria in the northern part of Shan State to be 934.6 cases per 100,000 population (Ministry of Health, 2012). In our study we found no cases of malaria, which could be due to the National Malaria Control Program (NMCP) and international and local non-government organizations, such as HPA (WHO, 2015). According to a 2008 HPA report, in 2008 the malaria infection rate was 6.0% and in 2010 it was 4.98%. Only 39 and 27 people were reported to have ma-

laria during 2012 and 2013, respectively, in the Kokang area.

In our study, a large percentage of study subjects had no formal education or prenatal care. We also saw a large percentage of participants who had multiple parturitions without a skilled midwife present. Large families were common among our study subjects. All these factors might affect the health of lactating mothers. Since iron deficiency and malnutrition were the main factors associated with anemia in our study, the above factors were demonstrated to be related to the nutritional status. Several studies have reported a lower education level was associated with iron deficiency, since a low education level is associated with poorer occupations and thus determines the socioeconomic level of the family affecting the nutritional status; thereby increasing the risk of anemia (Tympa-Psirropoulou *et al*, 2008; Taha *et al*, 2014). A higher education level and economic status improve the chance of receiving good quality antenatal care, decreasing the chance of suffering from anemia (Joshi *et al*, 2014). A previous study found the larger the size of the household the greater the risk for anemia (Tympa-Psirropoulou *et al,* 2008; Zhao *et al,* 2014). Although the above factors were not related to anemia in our study, we still need to pay attention to these factors.

In our study, we found the source of drinking water was associated with anemia. Women who drank water from a river or spring might not result in anemia directly. Possible factors could be parasitic infections, particularly in the developing world where poverty prevails and water supply and sanitation are deficient (Yap *et al*, 2012) and malnutrition, the prevalence of malnutrition was positively correlated with the serum iron level (Haidar *et al*, 2003).

This was a cross sectional study. The answers on the questionnaire were subject to recall bias. The type of study prevents determining causality, only determining association between factors and anemia. We only tested hemoglobin and several important elements concentration. We did not measure indicators of iron status such as red blood cell parameters, ferritin, free erythrocyte protoporphyrin, serum and plasma iron, total iron binding capacity, transferrin saturation and serum transferrin receptor. We did not collect stool samples for parasitic infections. We did not determine vitamin A and folic acid levels. The high prevalence of anemia in our study and the poor health status of the study subjects provide a reason for developing interventions in this population.

In conclusion, we found a high prevalence of anemia among the lactating mothers studied in Kokang, Myanmar. Iron deficiency, malnutrition and poor water supply were associated with anemia. Relying on nutritional packages did not seem to affect anemia. Clarification of the types of anemia is important to guide appropriate interventions for this serious problem.

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