Pak J Med Res
Vol. 55, No. 1, 2016

Original Article

Vitamin A Deficiency Among School Going Children Affected by Flood

Saima Naz Mohsin, Farkhanda Ghafoor, Muhammad Aasim
PMRC Research Centre, National Health Research Complex, Shaikh Zayed Medical Complex, Lahore.

Received: 01 April 2015, **Accepted:** 06 April 2015, **Published:** 21 March 2016

Abstract

Background: Vitamin A deficiency increases the risk of night blindness and death due to common childhood illnesses that are prevalent during emergencies like floods. The relief diet provided to flood victims is often deficient in micronutrients and minerals including vitamin A. There is a need to assess the levels of vitamin A among flood affected children to prevent morbidity and mortality caused by malnutrition.
Objective: To assess the frequency of Vitamin A deficiency among school going children (8-14 years) affected and unaffected by floods of 2010 in district Nowshera.
Subjects and Methods: Study was conducted in Government-registered schools situated in flood affected and unaffected areas of district Nowshera of KPK Province of Pakistan. A total of 353 children (8-14 years) were registered for study, including 190 from flood affected and 163 from unaffected areas. A questionnaire was filled for each child which included the demographic information. Three milliliter blood was drawn from each child which was processed for the estimation of vitamin A levels. Data was entered and analyzed using SPSS 20.0.
Results: Among flood affected children frequency of vitamin A deficiency was 18.9%, whereas among flood unaffected children it was 6.1% showing strong association with children affected by floods ($p < 0.001$).Among illnesses during floods, children who had acute respiratory infection were on an average 3.5 times more likely to have vitamin A deficiency as compared to those who did not suffer from this disease ($p = 0.037$).
Conclusion: Vitamin A deficiency was substantially higher among children affected by floods and those who had acute respiratory infection.
Key words: Vitamin A deficiency, flood affected children, school going children.

Introduction

Vitamin A is a micronutrient, which commonly becomes deficient following disasters[1]. This can be caused both by a lack of micronutrients in the food being distributed in emergency relief programs, and also by various diseases like measles and diarrhea which are common in refugee camps and can reduce its absorption[1,2]. Vitamin A deficiency is associated with night blindness and increased mortality among refugee children[1]. Although school-age children are not as likely to die from vitamin A deficiency as younger children but around 85 million (7%) school-age children are vitamin A deficient[3]. This deficiency affects children's immune function and iron metabolism and increases their risk of mortality from infection. The provision of adequate amounts of vitamin A not only reduces child mortality related to vitamin A deficiency but also reduces their susceptibility to diarrhea.

Corresponding Author:
Saima Naz Mohsin
PMRC Research Centre, National Health Research Complex
Shaikh Zayed Medical Complex, Lahore.
Email: saimanmohsin@hotmail.com

In response to the emergency caused by the floods of 2010 in Pakistan, relief efforts were initiated to prevent loss of life from diseases and malnutrition. Malnutrition including vitamin and mineral deficiencies increase the risk of infection and over 50% childhood deaths[4]. The quality as well as the quantity of the food provided in emergency relief is therefore, vital to decrease the risk and severity of infectious diseases and their related mortality. Emergency food aid addresses nutritional needs including micronutrient deficiencies but is provided only for a limited number of times over a limited period, whereas, needs of specific target groups are often not fully met. Major agencies involved with providing emergency relief have adopted a planning figure for food aid that aims to protect minimal metabolic functions (at a minimalist "starvation-avoidance" level) and to reduce mortality by correcting preexisting nutritional deficiencies. But due to shortage of food and high morbidity rate during emergencies like flood the situation of micronutrient malnutrition becomes poorer and needs more attention.

Food programs organized by government or NGOs covers food supplementation for children 1-5

years of age[5] but there is no support targeting children 8-14 years. Currently no data is available that addresses the actual scenario of vitamin A deficiency among school going children aged 8-14 years during emergency situations like flood, as they are susceptible to severe malnutrition and are at risk of other diseases. The present study was done to determine vitamin A levels in school going children from flood affected area and compared to a control population of school going children who had not experienced flood.

Subjects and Methods

This was a cross sectional descriptive study. School going children aged between 8-14 years, who were registered in schools of district Nowshera, Pakistan were included in the study. Study participants included cases and controls. Cases were the children who had experienced overwhelming disaster caused by floods and were displaced from their houses. These children were selected from government-registered schools. Populations in nearby areas who were not affected by floods and who stayed in their houses safely during floods were selected as control. All children aged 8-14 years, who were attending government-registered schools after floods in district Nowshera were included in study, while all children of similar ages, who were registered in government schools in district Nowshera but did not join school after floods, were excluded from study.

Sample size was calculated at 5% level of significance, 80% power of test with expected difference of 16% for vitamin A between flood affected and unaffected population. The estimated sample size was 160 samples for each group.

A total of 360 children were enrolled from different schools of Nowshera, out of whom, 197 were affected from flood and 163 children were unaffected by floods.

Permission from District Coordination Officer (DCO) and Executive District Officer (education) Nowshera was taken. EDO education identified different schools in flood affected and unaffected areas. The selection of schools was based on the availability of school-children population (8-14yrs) attending that school at the time of survey. Heads of schools were approached, consent was sought to commence survey in their respective school. Participating children from each school were asked to bring their parents/guardians to school on the day and time decided by school head. After explaining the purpose of survey, a written informed consent was obtained from parents/guardians for the participation of their child in the survey. Parents/guardians were interviewed to fill the questionnaire. Response for managing food, drinking water and shelter was recorded on study proforma.

About 3 cc blood was drawn from each child; its serum was separated and stored at -20ºC till analysis. Levels of serum vitamin A were estimated using commercially available ELISA kits from ABO Switzerland Co., Ltd. Cutoff levels for vitamin A used for the evaluation of enrolled study participants were defined as Deficient < 349 nmol/L, Low 349-698 nmol/L and Normal > 698 nmol/L

Data was entered and analyzed using SPSS, version 20.0. Association of vitamin A deficiency with flood was determined using chi-square test and association of vitamin A deficiency with illness during flood was explored using binary logistic regression analysis and was presented as adjusted odds ratios.

Ethical clearance was obtained from Institutional Review Board (IRB) of Shaikh Zayed Post Graduate Medical Institute, Lahore (IRB No. 1150).

Results

Initially 360 children were registered for survey but data of 7 children was incomplete; therefore, data for 353 children aged between 8-14 years was analyzed for interpretation of results. Among them 190 were affected by floods and 163 were not affected and stayed in their home safely during 2010 floods. Among 190 children in flood affected group 76 (40%) were males and 116 (60%) females. In this group 57 (30%) males and 88 (46.3%) females were up to the age of 11 years whereas 19 (10%) males and 26 (13.7%) females were above 11 years of age. In unaffected group, out of 163 children 97 (59.4%) were males and 66 (40.6%) females. In this group 69 (42.3%) males and 44 (26.9%) females were up to 11 years of age while 28 (17.1%) males and 22 (13.7%) females were above 11 years.

The average family size of flood affected children was 8.0 ± 3.2 and that of unaffected was 7.4 ± 2.3. The family heads of 169 (88.9%) flood affected children were fathers, 9 (4.7%) mothers and 12 (6.4%) guardians. In the unaffected children, family heads of 138 (84.7%) were fathers, 18 (11%) mothers and 07 (4.3%) guardians.

Professionally, in flood affected children, the family heads of 26 (13.7%) children were drivers, 69 (36.3%)laborer, 17 (8.9%) government servants and 11 (5.8%) private workers, while 25 (13.1%) were earning through small business. Among 163 unaffected children, the family heads of 20 (12.3%) were drivers, 35 (21.5%) laborer, 23 (14.1%) government and 12 (7.4%) private workers, while 20 (12.2%) were earning through small business.

Monthly household income from all sources was less than USD 102 for 137 (72.1%) flood affected and 76 (46.6%) unaffected children. Monthly income between USD 102 to 255 was in 44 (23.1%) flood affected and 74 (45.5%) unaffected children, whereas monthly income more than USD 255 was seen in 9 (4.8%) flood affected and 13 (8.0%) unaffected children.

Literacy wise, both parents of 102 (53.7%) flood affected and 69 (42.3%) unaffected children were

illiterate. In 46 (24.2%) flood affected children and 52 (31.9%) unaffected children mothers were illiterate and fathers were literate and 9 (4.7%) flood affected and 8 (4.9%) unaffected children had literate mothers and illiterate fathers. Both parents were literate in only 19 (17.4%) flood affected children and 34 (20.9%) unaffected children.

Among the subgroup of flood affected children, 55 (28.9%) were shifted to IDP camps, 21 (11.0%) stayed in their own homes, 86 (45.2%) moved to some relatives, 9 (4.7%) went into self arranged camps and 19 (10.2%) took refuge in schools or mosques.

Almost 40% children were displaced from their homes for less than 5 days, 36.3% for 5-10 days, 23.7% for > 10 days. During this period cooked food was provided (Daal Channa) to 149 (78.4%), snacks / milk, biscuits to 30 (15.8%) and food ration packages to 11 (5.8%) children. The food was provided through NGOs to 96 (50.5%), WHO, World Food Program to 35 (18.4%), local friends and relatives to 21 (11.0%), political workers to 16 (8.4%), government to 9 (4.9%) and was arranged by parents for 13 (6.8%) children. The main source of drinking water was community tanks for 116 (67.0%) children, hand pumps for 29 (15.3%), taps for 11 (5.8%), mineral water for 26 (13.7%), pond or river water for 3 (1.6%), tube wells or wells for 5 (2.6%).

Vitamin A status was normal in 13 (6.8%) flood affected and 40 (24.5%) unaffected children, low vitamin A levels were seen in 141 (74.2%) flood affected and 113 (69.4%) unaffected children. Vitamin A deficiency was present in 36 (18.9%) flood affected and 10 (6.1%) unaffected children. Frequency of vitamin A among flood affected children was 18.9 % and in unaffected children 6.1% (Figure). Strong association of vitamin A deficiency was seen in children affected by floods (χ^2 = 15.403, $p < 0.001$).

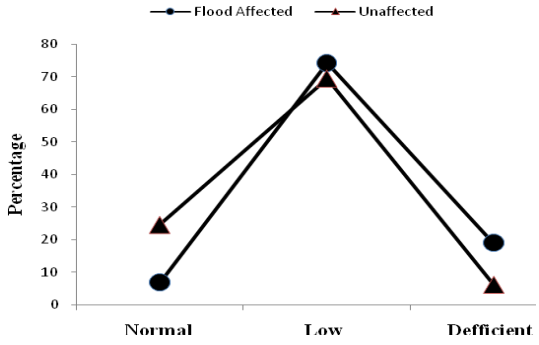

Figure: Frequency of vitamin A deficiency among study population. χ^2= 15.403, $p < 0.001$

Since vitamin A deficiency was significantly higher among children affected by floods. Logistical regression analysis for the illness during floods as causative factors of vitamin A deficiency was explored and it was observed that among illnesses during floods, children who had acute respiratory infection (ARI) were on average 3.5 times more likely to have vitamin A deficiency as compared to those who did not suffer from this disease (p = 0.037). Neither Diarrhea nor fever during floods showed any significant impact on vitamin A deficiency (p= 0.716 & 0.846) respectively (Table-1).

Out of 353 children enrolled in the study, 16 (4.5%) reported night blindness and in 28 (7.9%) children there was a family history of night blindness. Out of 28 family members who were suffering from night blindness 23 were immediate relations (father, mother, brother or sister) of the enrolled child, while 5 were first degree relatives other than immediate relations (grandmother, grandfather or uncle).

Table 1: Association of Illness during floods with vitamin A deficiency using logistic regression analysis.

Illness during Floods	*B*	*S.E.*	*Wald*	*df*	*p-value*	*Adjusted Odds Ratio*
Diarrhoea	-.179	.491	.132	1	.716	.836
Fever	.104	.536	.038	1	.846	1.110
Cough	1.258	.603	4.356	1	.037	3.518

Most of the children with night blindness or with family history of night blindness, had either low or deficient vitamin A level but due to small number of positive cases, neither night blindness of enrolled children nor family history of night blindness showed any statistical association with vitamin A deficiency (p = 0.363, & 0.116).Relationship between night blindness among immediate family member with vitamin A deficiency was also not found ($p < 0.160$) (Table-2).

Table 2: Association of night blindness with vitamin A status.

Night Blindness	*N*	*Vitamin A Status*			*p-value*
		Deficient	*Low*	*Normal*	
Self	16	03	10	03	0.363
Family history	28	3	19	6	0.116

Discussion

In the present study, Vitamin A deficiency was substantially higher among flood affected children. The initial phase of the disaster is manifested by inadequate access to food coupled with an inadequate supply of safe water and poor environmental hygiene and sanitation. All these factors place children at increased risk for malnutrition.

In developing countries, natural disasters can contribute to malnutrition because they make it hard for people to get the food that is needed. It was reported by United Nation ISDR, that poorer communities endure an inconsistent share of calamity loss[6]. Pitiable households are usually less supple to loss and are not often covered by indemnity or social protection. Disaster impacts lead to

income and consumption shortfalls and negatively affect welfare and human development, frequently over the long term[7]. It was observed in this study that most families of flood affected children were socioeconomically poorer than unaffected children because most of them had their monthly income USD ≤ 102 from all sources. This group constitutes 72% of the enrolled flood affected children as compared to 46.6% among unaffected.

Previous studies have shown that Vitamin A, Vitamin C, Iron, zinc and Niacin are common micronutrient deficiencies seen in disasters[7,8]. In this study vitamin A deficiency was significantly associated with children affected by floods.

The deficient and low levels of Vitamin A in flood affected children in the current study are in agreement with the findings of another study in which serum retinol levels were below 0.35 mmol/l and between 0.35 and 0.70 mmol/l in 8.4% and 51.1% children respectively[9]. In South Africa a prevalence of 39.1% subclinical vitamin A deficiency was reported in children aged 6–11 years[10], whereas for children under 6 years of age the corresponding figure was 33.1% [11]. These results and the present findings underline the magnitude and severity of vitamin A deficiency in an age group that health planners and policy-makers need to consider and address.

It was observed among illnesses during floods, children who had respiratory tract infection were nearly 4 times more likely to suffer from vitamin A deficiency as compared to others. Other workers also reported that vitamin A deficiency was a significant risk factor for acute respiratory tract infection[12,13].

Acknowledgement

Authors highly acknowledge the support of Pakistan Medical Research Council, Islamabad Pakistan for approving and funding this project. The Investigators of this project are extremely grateful to Maj. Khurram Khalid for arranging the stay for research team in Army Mess, Mr. Shaukat Durrani, UM Trust for coordinating with DCO and EDO Nowshera, and with Head Masters / Head Mistress of selected Govt. Schools. The authors are also grateful to Mr. Iqdar Durrani for providing space in his house for setting up temporary laboratory. The investigators are also thankful to staff of NHRC for their endless support in accomplishing this project.

Authors Contribution

SNM proposed idea for project, did data collection, analysis of samples for vitamin A, analysis briefing and tabulation of data, as well as manuscript writing. FG obtained permission from DCO and EDO Nowshera for conducting research project in government schools of Nowshera, made arrangements for stay as well as for establishment of temporary lab for initial processing of samples and their proper storage, she was also involved in data collection and proof reading of manuscript. MA entered data on SPSS and did final statistical analysis.

Conflict of interest: None declared.

References

1. Noji EK. The public health consequences of disasters. Oxford and New York. Oxford U Press 1997:51–61.
2. FAO Corporate Document Repository. Protecting and promoting good nutrition in crisis and recovery. Produced by agriculture and consumer protection. (Accessed on 12th March, 2016) Available from URL: http://www.fao.org/docrep/008/y5815e/y5815e05.htm
3. The partnership for Child development. Provision of school-based health and nutrition services Successes and lessons learned from Nasirnagar, Bangladesh 2009. (Accessed on 25th March, 2009) Available from URL: http://www.schoolsandhealth.org/Documents/Bangladesh%20Successes%20and%20lessons%20learned%20from%20Nasirnaga%20Provision%20of%20school-based%20health%20and%20nutrition%20services%20Brief4.pdf
4. Pelletier DL, Frongillo EA Jr, Schroeder DG, Habicht JP. The effects of malnutrition on child mortality in developing countries. Bull World Health Organ 1995;73:443–8.
5. UNICEF Pakistan Flood relief: weekly situation report 5 - 11 November 2010. (Accessed on 7th March, 2016) Available from URL: http://reliefweb.int/sites/reliefweb.int/files/resources/330E38621AAA543DC12577DB003DE731-Full_Report.pdf
6. Global assessment report on disaster risk reduction; United Nations ISDR 2009. (Accessed on 18th September, 2013) Available from URL: http://www.preventionweb.net/files/9414_GARsummary.pdf
7. Zhao XF, Yin SA, Zhao LY, Fu P, Zhang J, Ma GS. The nutritional status among children under 60 months year-old after one year of the Earthquake in Wenchuan. Zhonghua Yu Fang Yi XueZaZhi 2010;44(8):691-5.
8. Ojofeitimi EO, Owolabi OO, Aderounmu A, Esimai AO, Olasanmi SO. A study on under five nutritional status and its determinants in a semi – rural community of Ile-Ife, Osun State, Nigeria. Nutr Health 2003;17:21–7.
9. Kassaye T, Receveur O, Johns T, Becklake RM. Prevalence of vitamin A deficiency in children aged 6–9 years in Wukro, Northern Ethiopia. Bull World Health Organization 2001;79(5):415-22.
10. Van Stuijvenberg ME. Effect of iron-, iodine-, and ß-carotene-fortified biscuits on the micronutrient status of primary school children: a randomized controlled trial. Am J ClinNutr 1999;69:497–503.
11. Ramaligaswami V. Challenges and opportunities – one vitamin, two minerals. World Health Forum 1992;13:222–31.
12. Cameron C, Dallaire F, Vézina C, Muckle G, Bruneau S, Ayotte P, et al. Neonatal vitamin A deficiency and its impact on acute respiratory infections among preschool Inuit children. Can J Public Health 2008;99(2):102-6.
13. Sommer A, Kaiz J, Tarwotojo I. Increased risk of respiratory disease and diarrhea in children with preexisting vitamin A deficiency. Am J Clin Nutr 1984:40:1090-95.