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Original Article

Comparison of Nutritional Status among, Flood Affected and Unaffected School Aged Children

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Abstract

Background: Natural disasters like floods affect large human populations by not only displacing them temporarily but also poses nutritional issues to women and children.
Objectives: To determine the long term effects of floods, on the nutritional status of school going children in Pakistan.
Study design, settings and duration: A cross sectional study which was conducted in public schools of district Nowshera which is a large district of province Khyber Pakhtunkhwa, Pakistan from February 2012 to March 2014.
Subjects and Methods: A total of 353 children aged 6-14 years were enrolled. There were 190 children from flood affected areas and 163 controls from unaffected areas. Using height, weight, age and gender, malnutrition indicators like acute malnutrition, chronic malnutrition and underweight were calculated to evaluate effect of flood on these children after 20 months of the calamity. Weight for age (WAZ) was used to measure underweight, height for age (HAZ) to measure stunted growth, and weight for height (WHZ) to measure wasting or acute malnutrition. The malnutrition indicators which were positively associated with floods were further evaluated for associated factors.
Results The frequency of acute malnutrition or wasting (WHZ) among flood affected children was 23.7% as compared to 16.5% among unaffected children while the frequency of underweight (WAZ) in flood affected areas was 42.1% as against 36.8% in unaffected areas (both were not significant). The frequency of chronic malnutrition or stunting (AZ) was 35.8% in affected and 27.6% in unaffected children ($p< 0.041$) and was the only positively associated indicator with exposure to floods. Factors associated with chronic malnutrition were age of the child, maternal education, history of fever, administration of de-worming medication and diarrhea.
Conclusion: Floods had a long term effect on nutritional status of school aged children as shown by chronic malnutrition or stunting.
Policy message: Following floods and natural disasters, appropriate measures should be taken by the policy makers and the health departments to ensure provision of good food to fulfil nutritional requirements of school aged children.
Key words: Malnutrition, floods, school aged, children.

Introduction

The 2010 floods of Pakistan represent largest ever documented natural disaster, in terms of area and number of people affected. The floods took 1800 lives, 2966 were injured and 21 million people were affected in over 11000 villages.[1]

One of the most untoward consequences of this disaster was exposing the most vulnerable to further threat of mortality and morbidity, in particular the children. Long term effects of floods; include loss of livelihood, damage to food stocks and standing crops, loss of livestock, household food insecurity and property damage. All these collectively led to worsening of underlying chronic malnutrition in children. The unconstructive impact of specific large-scale natural disasters on children's human capital in developing countries has been documented. Such disasters affect the nutritional status of children and consequently their school performance.[2,3] In Pakistan, one year following floods; about 97% of the displaced population returned to their homes only to struggle for survival in a set up that experienced loss of infrastructure, healthcare facilities, schools and safe drinking water. The floods affected nutritional status of the children, which was confirmed and reported to be well above emergency threshold.[4]

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Authors Contribution

SNM did the conceptualization of project and data collection. MF and RG have done the literature search. Statistical analysis was done by MA. SNM, MF and RG also did the drafting, revision and writing of the manuscript.

Almost 23% children were reported as acutely malnourished while 6% were severely malnourished.[5] There are reports on the consequences of natural disasters on younger children less than 5 years of age [6] however, little is known about long term effects of such events on nutritional status of school aged children. This study aims to focus on the long term effects of floods on nutritional status of children aged 6-14 years.

Subjects and Methods

This was a cross sectional study which was conducted in public schools of district Nowshera which is a large district of province Khyber Pakhtunkhwa, Pakistan; and was one of the worst affected areas by floods of 2010.

Flood affected group of children aged 6-14 years were selected from 6 public schools in flood affected areas of District Nowshera and controls were enrolled from 3 public schools in the area that remained safe from the devastation of floods and where people remained in their houses and did not move out.

Sample size was calculated using the United Nations Standing Committee on Nutrition's recommended software for emergency nutrition surveys [7] with 5% level of significance and 80% power of test. A sample of 160 children for each group was calculated making a total of 320 children. To cater for drop outs and refusal, a total of 353 students were enrolled from public schools of District Nowshera. Out of these; 190 children were enrolled from 6 schools of flood affected areas who were displaced from their homes during the floods, and 163 were enrolled from 3 schools of flood unaffected areas. An informed consent was taken from the parents/ guardians of the children after explaining the study protocol. Parents/ guardians filled the written questionnaires, and teachers helped them in translation where required.

Age, weight, height and gender were taken to calculate anthropometric indices, including height for age (HAZ), weight for Age (WAZ), and weight for height (WHZ). Weight of each child was recorded while lightly dressed and without shoes. The weight was calculated in kilograms (kg) to the nearest 0.1kg using electronic scale and height was recorded in centimeters (cm) to the nearest 0.1 cm using standometer. Age of the children was recorded from school database and then verified by parents.

These indices were expressed in terms of z-scores, relative to the international WHO growth standards for school going children, and were later used to classify malnourished children.[7] The above measurements were taken to calculate the deviation from normal (z-score) of three standard measures: weight for age (WAZ) to measure underweight, height for age (HAZ) to measure stunted growth, and weight for height (WHZ) to measure wasting or acute malnutrition in children, based on the WHO guidelines.

Children were classified as normal if they had a WAZ equal to or above -2 (or 80% of the median). Global acute malnutrition (GAM) was the term used to indicate thinness in malnourished children. Acute malnutrition (thinness) was assessed by calculating body mass index (BMI), and then adjusting for age to generate BMI for age z- score as recommended by WHO.[4,8] If the WHZ scores were less than -2 z-scores (or below 80% of the median) and equal to or above -3 z-scores (or 70% of the median), then they were classified to have moderate-acute wasting. Children with score below -3 z-scores (or 70% of the median) or with edema on both feet, were classified as severely acute malnourished.[4]

Global chronic malnutrition (GCM) is the term used to indicate both moderate and severe stunting. It is calculated using height for age (HAZ) z-scores and were classified as moderate z-score (<-2SD to >-3 SD) to severe (<- 3SD). Weight for age was used to assess underweight children and were presented as z-scores and also classified as moderate (<-2SD to >-3 SD) to severe (z-score <-3SD).

Data was analyzed using IBM Statistics 20.0. Z-score were calculated using measure of locations. Frequencies and percentages were used to present cases among two groups as per risk factors. Chi Square was used to see association of individual risk factors with chronic malnutrition adjusted odd ratio were calculated along 95% confidence interval by using binary logistic regression analysis.

The authors assert that all procedure contributing to this work comply with the ethical standards of the relevant national and institutional committees of human experimentation and with the Helsiniki Declaration of 1975, as revised in 2008.

Ethical approval was obtained from Institutional Review Board (IRB) of Shaikh Zayed Post Graduate Medical Institute, Lahore.

Results

Among the flood affected children, normal BMI for age (z-score ≥ -2SD) was seen in 145 children and these figures were 136 in unaffected children. When measured for GAM by calculating WHZ scores (z-score < -2SD) it was found that 45 flood affected and 27 unaffected children were acutely malnourished. Out of 45 flood affected acutely malnourished children, 35 had moderate malnutrition (z-score < -2SD to >3SD) and 10 severe malnutrition (z-score < -3SD). Among 27 unaffected children, 19 had moderate malnutrition (z-score <-2SD to >3SD) and 8 severe malnutrition (z-score < -3SD). The overall frequency of GAM (thinness) was 23.7% among flood affected and 16.5% among unaffected children. Even though GAM scores were higher in flood affected children compared to unaffected, this difference was not statistically significant (p> 0.196).

WAZ scores showed that out of 190 flood affected children; 110 had normal weight for age (z-score > -2SD) while 80 were underweight for their age (< -2SD z-score). Out of 80 underweight cases, 53 were moderately underweight (WAZ score <-2SD to >-3SD) and 27 were severely underweight (WAZ score <-3SD). Frequency of underweight among flood affected children was 42.1%. Similarly out of 163 unaffected children; 103 were normal for their weight for age (WAZ score > -2SD) and 60 were underweight i.e. weight for age (WAZ score < -2SD). Among 60 underweight cases 38 were moderately underweight (WAZ score <-2SD to >-3SD) and 22 were severely underweight (WAZ score <-3SD). Frequency of underweight among unaffected children was 36.8%. Though the frequency of underweight was higher among flood affected population as compared to unaffected but the difference was not statistically significant. (p> 0.560) (Table-1).

The prevalence of chronic malnutrition (stunting) index was assessed using height for age z-scores HAZ. Among 190 flood affected children 122 had normal height for their age (zscore> -2SD), while 68 showed stunting (height for age <-2). Among 68 cases of chronic malnutrition; 41 had moderate (HAZ score <-2SD to >-3SD) and 27 had severe malnutrition (HAZ score <-3SD). Frequency of chronic malnutrition (stunting) among flood affected children was 35.8%. Similarly among 163 unaffected children, 118 were normal for their height for age (HAZ score -2SD) however 45 were suffering from chronic malnutrition having height for age <-2SD. Among 45 GCM cases 33 had moderate chronic malnutrition (HAZ score <-2SD to >-3SD) while 12 had severe chronic malnutrition (HAZ score <-3SD). Frequency of chronic malnutrition (stunting) among flood unaffected children was 27.6% and this difference when compared with flood affected children was significant (p< 0.041) (Table-2).

The association of various factors for chronic malnutrition was calculated using odds ratio The variables selected were; the two study groups i.e. flood affected and unaffected, gender, age, monthly household income, mother's education, evidence of de-worming, diarrhea, fever and cough (Table-3). The flood affected group showed higher odds of 1.46 for being chronically malnourished (p< 0.099) as compared to unaffected group. Age was a significant factor as children aged >11 years had 1.96 times higher chance of being chronically malnourished as compared to those ≤11 years (p< 0.009). Similarly the children who had fever of unknown origin during floods had 1.48 times higher chance of being chronically malnourished (p< 0.029). Flood affected children who underwent de-worming, three months prior to the study period or had diarrhea during flood time were 2.6 and 1.9 times more prone to be chronically malnourished (p< 0.013 and 0.083 respectively). Maternal education showed significant association with stunting as children of educated mothers had 3.5 times lesser chance of getting stunted (p< 0.001). Cough, monthly income and gender did not show any affect on chronic malnutrition among flood affected children.

Discussion

Pakistan has acute malnutrition rate of 13.1% which is very close to WHO emergency threshold of 15% [9] and the 2010 catastrophe of flood of such a large scale disaster must have significantly increased the mortality and morbidity due to underlying malnutrition in children. Studies following large-scale natural disasters have shown a negative impact on children's nutritional status in general and on schooling outcomes in particular.[2,3] In the present study three anthropometric indices were used including underweight, wasting and stunting. Wasting or acute malnutrition was calculated as weight for height or GAM thinness which was found to be higher among flood affected children (23.7%) as compared to unaffected (16.5%) but the difference was not significant. Our finding was contrary to other studies that support GAM thinness is higher among flood affected population.

Table 1: Frequencies of underweight (weight for age z-score) among study population.

Study Groups	*N*	*Underweight (Weight for Age z-score)*				*p- value*
		Normal z-score >-2SD	*Moderate z-score = <-2SD to >-3SD*	*Severe z-score < -3SD*	*Global z-score < -2SD*	
Flood Affected	190	110	53	27	80	
Unaffected	163	103	38	22	60	0.560
Total	353	213	91	49	140	

Table 2: Chronic malnutrition (height for age z-score) among study population.

Study Groups	*N*	*Chronic Malnutrition (Height for Age z-score)*				*p-value*
		Normal z-score >-2SD	*Moderate z-score = <-2SD to >-3SD*	*Severe z-score < -3SD*	*Total z-score < -2SD*	
Flood Affected	190	122	41	27	68	
Unaffected	163	118	33	12	45	0.041
Total	353	240	74	39	113	

p-value calculated for comparison of sever chronic malnutrition between two groups.

Table 3: Factors associated with chronic malnutrition.

Chronic malnutrition variables	N*	n (%)**	OR	95% CI	*p*-value
Group					
Flood affected	190	68 (35.8%)	1.46	0.93-2.30	0.099
Unaffected	163	45 (27.6%)			
Gender					
Male	173	54 (31.2%)	0.93	0.60-1.46	0.841
Female	180	59 (32.8%)			
Age					
>11 years	95	41 (43.2%)	1.96	1.20-3.20	0.009
≤11 years	258	72 (27.9%)			
Income					
≤25000	207	70 (33.8%)	1.22	0.77-1.93	0.453
>25000	146	43 (29.5%)			
Mother education					
Illiterate	211	89 (42.2%)	3.59	2.14-6.02	<0.001
Literate	142	24 (16.9%)			
Deworming					
Yes	32	17 (53.1%)	2.66	1.28-5.54	0.013
No	321	96 (29.9%)			
Diarrhoea					
Yes	37	17 (45.9%)	1.95	0.98-3.88	0.083
No	316	96 (30.4%)			
Fever					
Yes	69	14 (20.3%)	0.48	0.25-0.90	0.029
No	284	99 (34.9%)			
Cough					
Yes	35	13 (37.1%)	1.29	0.62-2.66	0.621
No	318	100 (31.4%)			

N* = Total number of cases for each category of variables under study, n(%)** = Number of chronically malnourished children among N

A study of children of internally displaced persons aged 6–59 months from northern Chad reported 20.6%, prevalence of acute malnutrition rates (according to WHO standards), compared to 16.4% in children of non-displaced persons living in villages, and 10.1% in town.[10] Another study from Sri Lanka during emergency situation, reported GAM of 36%.[11] In evaluation report of two surveys conducted in Provinces of Punjab and Sindh in Pakistan, GAM among flood victims of Punjab and Sindh was 14% and 22% respectively during 2010 floods.[12] Our results however, show long term effects of flood on nutritional status of victims and therefore could be different from above studies that focus on short term effects.

Height-for-age is an indicator of past nutritional status or chronic malnutrition (stunting). In the present study, the prevalence of chronic malnutrition was significantly higher among flood affected children (35.8%) as compared to unaffected (27.6%). This finding was in accordance with a survey conducted following an earthquake in Pakistan in 2005, which reported stunting in 38.1% in Muzaffarabad and 54.8% in Khyber Pakhtunkhwa province.[13] Similarly the figures of chronic malnutrition among flood victims of Punjab and Sindh aged 6-59 months were 49% and 52% respectively during 2010 floods [12] which are similar to our study. Our findings are also supported by report from rural eastern India where stunting among flood affected children of 6-59 months was seen.[6] A Nigerian study on school-age children also showed higher stunting in children aged over 10 years following floods.[5,14]

Our study did not show any significant difference in the prevalence of underweight among flood affected children or unaffected children. These results were however not in agreement with a study in flood victims from India, where flood effected children 6-59 months were three times more likely to have wasting (38.7%) as compared to unaffected (16.5%).[15] Another study from Pakistan also reported underweight in flood affected children (46.7% in Sindh and 39% in Punjab).[13] This study however included children under age of 6 years while we have included children aged 6-14 years.

Maternal education was strongly associated with prevalence of stunting.[15,16] Maternal education can not only contribute to total family income and improve the economics of family and thus lead to better nutritional status but literate mothers can make better decisions and food choices that can improve nutrition and health of their children.[17] Diarrhoea was positively associated with chronic malnutrition in our study. This association has been previously documented and is attributed to impaired absorption of nutrients.[18]

Children who had received de-worming medication during last 3 months prior to data collection presented with high percentage of chronic malnutrition as compared to others. This indicates that these children suffered from some parasitic infections because helminthic infections are associated with stunting, wasting and

anemia. Therefore, anti helmenthic drugs are recommended to be incorporated with simple and inexpensive nutritional interventions such as micronutrient supplements to promote recovery and growth of children.[19] In the present study, recurrent fever in previous six months was significantly associated with stunting. Another study reported stunting and a 44% increase in the incidence of cough and fever during school year.[20] Malnutrition in school children may have long term negative effects, and the covariate nature of disasters like floods can make them more difficult to cope with. The present study conducted 20 months following floods has highlighted that even though the flood victims return to their normal life, the floods still leave a permanent effect on health as well as nutritional status of children (6-12 years), pushing them to malnutrition and stunting. This vulnerable population not only requires support and encouragement but also needs attention of policy makers and the health and food program to combat the issue.

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