

ORIGINAL ARTICLE

ASSOCIATION BETWEEN DRINKING WATER SOURCES AND DIARRHEA WITH MALNUTRITION AMONG KINDERGARTEN'S CHILDREN IN BAGHDAD CITY, IRAQ

Hasanain FG, Jamsiah M, Zaleha MI, Azmi MTamil, Mohammed AA

Department of Community Health, UKM Medical Centre, Kuala Lumpur, Malaysia.

ABSTRACT

Malnutrition is associated with childhood diseases such as diarrhea or other severe illness. Children who suffer from repeated episodes of diarrhea are more likely to suffer from malnutrition. In addition, the source of drinking water is a very important factor affecting the nutritional status. The objective of this study was to find out the prevalence of malnutrition condition among children aged 3 to 5 years old and the factors associated with it. A cross sectional study using simple random sampling was conducted among 220 children aged 3 to 5 years old from four kindergartens in Baghdad city, Iraq. Nutritional assessment was carried out using the indicator weight-for-age z-score based on World Health Organization cut off points. Acute malnutrition was found in 18.2 % of the respondents. In this study 65 % of the respondents used tap water to drink as compared to 35 % who used sterilized bottles as source of drinking water. The environmental factors mainly the source of drinking water was significantly associated with child nutritional status ($p=0.034$). The prevalence of diarrhea and admissions to the hospital due to diarrhea were also significantly associated with malnutrition ($p < 0.01$, $p < 0.01$) respectively. In conclusion, the effect of diarrhea on child nutritional status is very important and till now considered the major cause of child malnutrition. Shortage of safe drinking water in Iraq can lead to an increase in diarrhea cases and eventually leading to child malnutrition.

Key words: Malnutrition, tap water, diarrhea, admission to the hospital.

INTRODUCTION

Iraq is a developing country experiencing constraints on economic and social development and most of the environmental factors affect the physical growth of children including poor food consumption patterns, illness, lack of sanitation, poor hygiene practices and poor health care coverage and resources¹.

Underweight children are particularly vulnerable to increased risk of death from infectious illness such as diarrhea and pneumonia. For those children who do survive, the impacts of chronic malnutrition in the first few years of life are long-lasting and can lead to cognitive and physical developmental deficits, higher levels of chronic illness and disability in adult life (resulting in reduced work capacity), as well as adverse pregnancy outcomes (low birth weight)².

For children in developing countries, the average estimated incidence of diarrhea is 2.6 episodes per annum, resulting in 2.2 million deaths annually. In the same population segment, malnutrition is a considerable health problem with prevalence rates estimated to range from 4% to 46% with 1% to 10% severely malnourished³.

An adequate amount of water is needed to satisfy metabolic, hygienic, and domestic requirements, usually about 20 liters per person per day. This measure is used to proxy the broad dimensions of countries' health environment, including access to sanitation and health care. Countries with high safe water access are likely to have good health environment and services overall⁴.

Child malnutrition is a serious problem in Iraq, not just during the period after 2003 but before that since 1991 war and the following 13 years of economic sanctions.

This study was carried out in Baghdad city which is the capital of Iraq after 6 years of war in 2003 to assess the nutritional status of children aged 3 to 5 years old, and the effect of drinking water origin and acute gastroenteritis problem among children.

MATERIAL AND METHODS

The purpose of this study was to find out the prevalence of malnutrition among this age group of children and relevant factors associated with malnutrition. A cross-sectional study was conducted on 220 respondents aged between 3 to

5 years old from four different kindergartens in Baghdad city, Iraq during May 2009.

A list of all kindergartens in Baghdad was obtained from the Ministry of Education. Selecting four kindergartens from different areas of Baghdad was carried out using simple random sampling method. Subsequently, a complete list of student names in each selected kindergarten was obtained, 55 children from each kindergarten were then identified also by simple random sampling method.

Both questionnaire and anthropometry measures were used in this study. The self administered questionnaire was translated from English to Arabic language. This questionnaire was then distributed to the respondent's parents during the monthly meeting with the teachers in the kindergartens.

Malnutrition indicator in this study was underweight which is defined as having low weight for age by obtaining the Z score and compares it to the WHO cut off points (2007). Z score of <-2 is considered as malnourished. The drinking water source in this study was defined as the sources whether unsafe like the tap water or the safest one which is the sterilized bottles. Diarrhea is defined as the passage of 3 or more loose or liquid stools per day. It was assessed in the last 6 weeks before the survey and also if the diarrhea led to child admission to the hospital.

The Statistical Package for Social Sciences (SPSS) version 16 was used for data analysis. Descriptive statistics was used to describe the source of drinking water and numbers of diarrhea episodes among the respondents. Comparisons among groups were made using appropriate inferential tests such as Mann-Whitney test; Chi squared test. The statistical significance level used was <0.05. Epi info version 6.0 software was used to obtain the weight for age Z score.

Ethical approval

This study was approved by the Research and Ethics Committee of Universiti Kebangsaan Malaysia Medical Centre (code FF-092-2009).

RESULTS

The prevalence of malnutrition in this study was 18.2 %. The mean age of children was 3.92 years old ($SD\pm 0.8$). The mean bodyweight was 15.63 kilograms ($SD\pm 3.18$), the minimum was 9.20 kilograms and the maximum was 25.1 as shown in Table 1.

Table 1. Demographic characteristics of the respondents

Variable	Frequency	Percent (%)
Sex of Child		
Male	125.0	56.8
Female	95.0	43.2
Mean \pm SD		
Age	3.92 \pm 0.8	3.0
Weight (kg)	15.36 \pm 3.18	9.20
		25.1

The distribution of the respondents by gender showed (57%) were males and (43%) were females.

The study showed that 65% of the families in Baghdad city used tap water as their source of drinking water as compared to 35% who used sterilized bottles. Diarrhea episodes in the last 6 weeks before the research was carried out as shown in Table 2 revealed that a total of 29.1 % of the children experienced diarrhea and 16.8 % of the children with diarrhea were admitted to hospital. The maximum number of diarrhea episodes was 5.

Table 2. Sources of drinking water and occurrence of diarrhea

Variables	Frequency	Percent (%)
Source of drinking water		
Tap water	143.0	65.0
Sterilized bottles	77.0	35.0
Presence of diarrhea		
Yes	64.0	29.1
No	156.0	70.9
Child admitted to hospital due to diarrhea		
Yes	37.0	16.8
No	183.0	83.2
Episodes of diarrhea		
0	156.0	70.9
1	24.0	10.9
2	23.0	10.4
3	12.0	5.5
4	3.0	1.4
5	2.0	0.9

The association between the source of drinking water and child malnutrition was significant ($p=0.034$) with prevalence odds ratio of 2.414. Table 3 shows significant association ($p<0.01$)

between diarrhea and child malnutrition with prevalence odds ratio of 4.587. The admission to hospitals due to diarrhea was also significant with $p < 0.01$ and the prevalence odds ratio is 5.048.

Table 3. Relationship between sources of drinking water and diarrhea with malnutrition

Variable	Nutritional status of the children (%)		p value	POR	(95%CI)
	Underweight	Normal			
Sources of drinking water					
Tap water	32 (22.4)	111 (77.6)	0.02*	2.48	(1.08-5.70)
Sterilized bottles	8 (10.4)	67 (89.6)			
Presence of diarrhea					
Yes	23 (35.9)	41 (64.1)	<0.01*	4.58	(2.23-9.39)
No	17 (10.9)	139 (89.1)			
Child admitted to hospital due to diarrhea					
Yes	16 (43.2%)	21 (56.8%)	<0.01*	5.04	(2.31-11.00)
No	24 (13.1%)	159 (86.9%)			

*Chi Square test was performed, Level of significant at $p < 0.05$, POR= prevalence odds ratio, CI=confidence interval.

DISCUSSION

The source of drinking water is very important for human health. In Iraq, most of the families use tap water to drink. In this study, 65 % of the respondents used it as compared to 34 % use sterilized bottles as source of drinking water.

The association between the source of drinking water and the children's nutritional status was significant ($p=0.034$), in which families that use tap water as source of drinking water have 2.4 times more risk to have malnourished children.

According to the United Nations report in 2007, shortage of safe drinking water in Iraq can lead to increased cases of diarrhea, a leading killer of children in the country. Sabotage and violence occurred in Iraq makes it difficult to protect Iraqi water officials and repairing of damaged pipes⁵.

The effect of diarrhea on children's nutritional status is very important and until now is considered the major cause of child malnutrition. According to Multiple Indicator Cluster Survey done by UNICEF in 1996 in Iraq , the prevalence of diarrhea in early age group (6 months to 2 years) was more than 50% while in 3 to 5 years old was between 10 to 20 percent .Therefore, the incidence of diarrhea decreased with increasing age of children⁶.

Al-Fadhily⁷ stated that much of the country is suffering severe lack of water, and the small quantities supplied are not safe for human use. It was also mentioned that when the pipe water was analyzed , the results was shocking .It was found that the water is not safe for human consumption and each time they analyzed it, various kinds of bacterial pollution and germs that might cause death were found.

The association between diarrhea and children's nutritional status was significant ($p < 0.01$) in which children with diarrhea have 4.5 times more risk to be malnourished. The admission to the hospital due to diarrhea was also significantly associated with malnutrition with $p < 0.01$ and the prevalence odds ratio of 5.048.

Serdan et al. (2009)⁸ conducted a study to assess the effects of war in Iraq on nutrition and health and concluded that children are more prone to get diarrhea in more violent districts. At the same time, households living in these areas are also more likely to have water, sewage and electricity problems. This suggests that the mechanism in which the violence and insecurity could affect child health is through the lack of well-functioning public services and more incidences of illnesses.

Our study findings are supported by the results of other studies. Moore et al.⁹ conducted a study to describe changes in the incidence of diarrhea and prevalence of malnutrition among children in an urban Brazilian City from 1989 to 1996. They found that marked changes over time in the diarrhea burden and nutritional status of children in this population and provided further evidence of a significant association between malnutrition and increased incidence of diarrhea.

Some of the limitations in this study includes small sample size; the study was not community based short time of data collection because of the security situation in Baghdad and the recall bias of the respondent's parents.

CONCLUSION

In this study, malnutrition remains the world's most serious health problem. The effect of diarrhea on child nutritional status is very important and considered the as a major cause of child malnutrition. Shortage of safe drinking water in Iraq can lead to increase diarrhea cases and lead to child malnutrition.

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