

**ARE DIARRHEAL INCIDENCE
AND MALNUTRITION
RELATED IN UNDER FIVE
CHILDREN ?
A LONGITUDINAL STUDY IN
AN AREA OF POOR SANITARY
CONDITIONS**

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ABSTRACT

This study was conducted in Atali and Garkhera villages of Faridabad district of Haryana to assess the relationship between diarrheal incidence and malnutrition. Two hundred and fifty children in the age group of 6-47 months were followed up for one year from June 1988. History of diarrheal episodes was ascertained by fortnightly home visits. Nutritional status (weight for age) of the children was assessed at the beginning of the study and at every four monthly interval. The mean diarrheal incidence was 2.88 ± 1.28 episodes per child year. The pre-valence of moderate to severe malnutrition in the children was 35% out of which 8.8% were severely malnourished. Although severely malnourished children had 0.56 more episodes of diarrhea in a year compared to normally nourished, the difference was not statistically significant. Similarly, number of episodes of diarrhea also did not affect the subsequent nutritional status of the children. The possible reason for this could be that in areas of poor sanitary conditions, nutritional status may not play an important role in increasing the susceptibility of children to diarrhea.

Key words: Diarrheal incidence, Malnutrition,

Among the major problems being faced by children of the developing world, two important ones are diarrhea and malnutrition. Although both of them seem to co-exist, the relationship between them is not yet clear. A plethora of studies(1-12)(7aWe /) on this subject testify to the fact that situation is far from clear. Unfortunately, there are many contradictions between the results of these studies, regarding the study design and the criteria used for defining both malnutrition and diarrheal morbidity.

Majority of the studies were longitudinal, but earlier studies had done the nutritional assessment only at the beginning of the study. In any longitudinal study, due to recurrent contact with the health personnel, the nutritional status of the children may improve. The difference in diarrheal incidence between different grades of malnutrition in such a case, even if present, is unlikely to be detected. The criteria for defining malnutrition also varies and, some studies(8,9) found that stunting is more important than wasting. Thus, there are many factors which affect the relationship between diarrhea and malnutrition. The present study was, therefore, done with the objective of assessing relationship between diarrheal incidence and malnutrition.

Material and Methods

The study was conducted in Garkhera and Atali villages of Faridabad district in

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Haryana. This forms a part of the field practice area of Primary Health Centre (PHC) Chhainsa, run by Centre for Community Medicine, All India Institute of Medical Sciences. A total of 250 children in the age group of 6-47 months were enrolled in the first week of June 1988. The unit of selection was households, which were selected by stratified (on the basis of caste) random sampling. All the children in the desired age group in the household were enrolled. The exact age was calculated as per records kept at PHC Chhainsa.

On the first visit, particulars regarding the family, weight of the child and any history of diarrhea in the preceding fortnight was recorded. Weight for age was taken as the criterion for malnutrition and grading done as suggested by the Indian Academy of Pediatrics. A Salter scale, standardized before use, was employed for weighing the children. Children were weighed with no or minimal clothes. Each household was visited fortnightly and any episode of diarrhea after the last visit was asked for. The World Health Organization's definition of diarrhea as three or more loose stools per day was used (13). The informants were almost always mothers.

If the child was having diarrhea, the necessary details were noted, the ORS packets with routine advice regarding ORT and causation and prevention of diarrhea was given. Nutritional advice was given to mothers of all malnourished children. This could lead to a bias in the study as during follow up, the diarrhoeal incidence may decrease and the nutritional status may improve, thus showing a spurious relationship between diarrhea and malnutrition. However, for ethical reasons, the advice has to be given. A cross-sectional study would avoid this problem but would not give

incidence figures.

The children were followed for one year till May 1989. Children were weighed every four months and classified into various grades of malnutrition. This meant that the child could contribute four months to one grade and four months to other. For the calculation of diarrheal incidence, the unit of child time scale was used (episode per child year).

The results were analyzed manually and appropriate statistical tests applied.

Results

A total of 250 children from 145 households in two villages were randomly selected and followed up for a period of one year. Two children died during following up from non-diarrheal causes. There were no other drop outs. The age-wise nutritional status of the children (*Table II*) revealed that malnutrition was maximum at second year of life. Sixty five (26%) of the study children were moderately malnourished and 22 (8.8%) had severe malnutrition. The prevalence of severe malnutrition decreased by half during the study (from 8.8% to 4.4%). This may be because of the nutritional advice given to mother of malnourished children. During the study period, a total of 719 episodes of diarrhea were recorded giving an incidence rate of 2.88 episodes/child year.

Incidence rate of diarrhea in children of various grades of nutritional status is shown in *Table III*. Children in Grade III malnutrition had 0.56 episodes of diarrhea more in a year compared to normally nourished children. However, this difference was not found to be statistically significant.

The impact of number of diarrheal episodes on the subsequent nutritional status of the child is shown in *Table IV*. Out of 454

TABLE I-Review of Some Studies on Malnutrition and Diarrhea

Reference	Author and year	Study details	Results
1.	Ghai <i>et al.</i> , 1970	Longitudinal study with initial weighing; 85% of expected weight considered malnourished	Diarrhea twice more frequent in malnourished when compared to normal
2.	James <i>et al.</i> 1972	Longitudinal study with initial weighing; Gomez classification for malnutrition	A positive correlation but valid only in children <36 months
3.	Martorell <i>et al.</i> 1975	Longitudinal study	Negative association between diarrhea and weight gain
4.	Palmer <i>et al.</i> 1976	Hospital based study of cholera patients	Cholera more severe and hospital stay prolonged for malnourished patients
5.	Chen <i>et al.</i> 1981	Prospective study with initial weighing only	No relationship between diarrhea and malnutrition
6.	Luwang <i>et al.</i> 1982	Cross sectional study	Diarrhea more common in malnourished children
7.	Black <i>et al.</i> 1984	Longitudinal study with two monthly nutritional assessment	Malnutrition is a determining factor in diarrheal duration only in children below 2 years
8.	Tomkins <i>et al.</i> 1987	Longitudinal study with repeated nutritional assessment	Duration of diarrhea increased in wasted and stunted children; incidence only in stunted
9.	Henry <i>et al.</i> 1987	Children below 3 years weighed six monthly	Only dysentery, not diarrhea, related to stunting
10.	Sepulveda <i>et al.</i> 1988	Longitudinal study with three monthly nutritional assessment	Diarrhea twice more frequent among malnourished
11.	El Samani <i>et al.</i> 1988	Longitudinal study with bi-monthly nutritional assessment	Moderate malnutrition was associated with two fold risk of diarrhea
12.	Walia <i>et al.</i> 1988	Longitudinal study with repeated weighing	Diarrheal incidence more in malnourished children

TABLE II-Nutritional Status of Children at the Beginning of the Study

Age (No.)	Grade of malnutrition			Total
	0&I	II	III & IV	
6.11	26 (60.5)	14 (32.5)	3 (7.0)	43
12.23	42 (56.0)	27 (36.0)	6 (8.0)	75
24- 35	48 (68.6)	13 (18.6)	9 (12.8)	70
36-47	47 (75.8)	11 (17.7)	4 (6.4)	62
Total	163 (65.2)	65 (26.0)	22 (8.8)	250

Figures in parantheses indicate horizontal percentages.

TABLE III-Incidence of Diarrhea in Various Grades of Malnutrition

Grade	Total child months	Total episodes	Incidence \pm SD (Episodes/child/year)
0 (Wt >81%)	866	205	2.84 \pm 1.32
I (Wt 71.80%)	1180	274	2.79 \pm 1.10
II (Wt 61-70%)	756	186	2.95 \pm 1.56
III (Wt <60%)	190	54	3.40 \pm 1.96
	2992	719	2.88 \pm 1.28

P >0.05 for all grades.

TABLE IV-Impact of Number of Episodes of Diarrhea in Children in Four Months on their

Number of episodes	Number of 4 monthly intervals	Subsequent nutritional status		
		Same	Improved	Worsened*
0	159	84.3	10.1	5.7
1	454	87.9	7.5	4.6
≥ 2	134	78.3	13.4	8.2
	747+	85.4	9.1	5.5

p >0.05.

* Figures are in percentage.

+ Out of 750 possible four monthly intervals (250 children x 3), 3 were lost due to deaths.

four monthly intervals in which an episode of diarrhea was reported by children, in 88% of the intervals, children did not change their nutritional status. As is evident, majority (85.4%) did not improve or worsen their nutritional status irrespective of the number of diarrheal episode in that interval. This suggests that nutritional status is not affected by the number of episodes of diarrhea.

Discussion

The study population was a rural one and prevalence of severe malnutrition was high (9%). The demographic picture and practices related to diarrhea have been published before(14). Although, the severely malnourished children had 0.56 episodes of diarrhea more than normally nourished, the difference was not significant. Similarly, number of episodes of diarrhea suffered by the children did not affect the nutritional status. Although, the study was biased towards-association, it had a negative conclusion.

The probable causes by which diarrhea could lead to malnutrition are: (a) loss of nutrients in stools, (b) malabsorption of nutrients during diarrhea and decrease in food intake both due to loss of appetite and restrictive feeding practices. The probable ways by which malnutrition could affect diarrhea is by depression of immunity, thus predisposing the child to infection. Thus, the observed relation between malnutrition and diarrhea in a particular study will depend upon these variables and their prevalence in the study population.

Another difficulty in assessing the relation between the two is the seasonality of both variables. Diarrhea has a well known seasonability (peak in mid-August) but malnutrition may also have a seasonally

declining in months of better food availability(15) when wheat is harvested (May-August). Seasonality of malnutrition is difficult to study by a longitudinal design as ethical reasons demand intervention in malnourished children.

Walia *et al.* (12), explain the discrepancy in findings of different studies on the basis of diarrheal morbidity prevalence. In areas where diarrheal morbidity is high, *i.e.*, areas of poor sanitation and socio-economic status, the ease with which infection can be transmitted may prevent nutrition from playing an important role. This could be one of the reason why the present study did not find any relationship between diarrheal incidence and nutritional status.

Age could also been a possible effect modifier, *i.e.*, the relationship between diarrhea and nutritional status may be true only for younger age group (<2 years). Due to small numbers in severe malnutrition group, this analysis could not be done.

Although, this study found no association between nutritional status and diarrheal incidence, a metaanalysis of all studies is recommended to come to a valid conclusion.

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