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**Original Research Article**

# Demographic profile of diarrhoea in malnourished children

**Anirudh Mahajan, Sharvil Dhar, Abhijay Mehta, Harsh V. Sharma, Ravinder K. Gupta***

Department of Pediatrics, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu and Kashmir, India

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***Correspondence:**
Dr. Ravinder K. Gupta,
E-mail: urvigupta00@gmail.com

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## ABSTRACT

**Background:** Diarrhoeal illnesses impair both weight and height gains, with the most pronounced impacts observed in cases of recurrent episodes. Malnutrition can exacerbate diminished human performance, hinder physical growth, and retard cognitive development, and it is concomitant with increased frequency, duration, and severity of diarrhoeal events. The interrelationship between diarrhoea and malnutrition is intricately linked to factors related to water, sanitation, and hygiene, albeit through distinct pathophysiological mechanisms. Recurrent diarrhoeal episodes, infections, and inadequate hygiene practices can exacerbate these outcomes. Essentially, each diarrhoeal episode exacerbates nutritional deficits and fluid loss, thereby intensifying the severity of both malnutrition and dehydration. Aims and objectives were to identify and describe the demographic profile of malnourished children who experience diarrhoea, including age, sex, birth order and immunization status and to evaluate the impact of demographic variables on the severity of diarrhoea in malnourished children.

**Methods:** The present observational study was carried out in Outpatient department as well as inpatient department in department of pediatrics at Acharya Shri Chander College of Medical Sciences and Hospitals after obtaining ethical permission from institution with reference no. ASCOMS/IEC/2024/Meeting-II/FM/15, over a period of six months, w.e.f. 01 January 2024 to 31 June 2024. A total of 260 malnourished children were included in the study after obtaining the informed consent from their parents/guardians.

**Results:** In our study out of 260 malnourished children of age group 6 months to 5 years, 125 had diarrhoeal disease in which 76 (60.8%) were male and 49 (39.2%) were females with male to female ratio was 1.55:1 and majority of the study subjects were in the age group of 1-2 years (60%), followed by 6-12 months (24%), followed by 2-5 years (16%) and out of 76 male malnourished children who had diarrhoea, 52.6% were found to have grade II Indian Academy of Pediatrics (IAP) classification of malnutrition followed by 21%, 18.4% and 8% have grade III, grade I and grade IV respectively whereas out of 49 malnourished female child who had diarrhoea, 34.7% were having grade I IAP classification of malnutrition whereas grade II and grade III were found almost similar numbers 26.5% and 24.5% respectively and 14.3% had grade IV IAP classification of malnutrition.

**Conclusions:** The present study concluded that the malnutrition engenders diarrhoeal manifestations through a variety of mechanisms, while diarrhoea, in turn, exacerbates the degradation of nutritional status. Moreover, 13.6% of cases of diarrhoea becomes chronic has significant implication and highlights the need of early intervention and effective management strategies to prevent acute cases from developing into chronic.

**Keywords:** Diarrhoea, Malnutrition, Dehydration, Dysentery

## INTRODUCTION

According to World Health Organization (WHO), there are approximately 1.7 billion cases of childhood diarrhoeal disease occur annually on a global scale, rendering it the second foremost cause of mortality among children under the age of five, representing a profound public health challenge. Despite numerous healthcare interventions implemented by governmental bodies, a significant proportion of children continue to suffer from diarrhoeal diseases.[1,2] According to the WHO, diarrhoeal disease is defined as the passage of three or more loose or liquid stools per day.[3] The nexus between malnutrition and diarrhoeal mortality is intrinsically bidirectional.[4,5] Diarrhoea correlates with suboptimal growth and developmental delays in young children. Post-diarrhoeal malnutrition emerges from a triad of anorexia, impaired absorptive capacity, and mucosal damage, compounded by nutrient depletion consequent to each diarrhoeal episode. Enteric infections account for a substantial fraction of global malnutrition. Diarrhoeal illnesses impair both weight and height gains, with the most pronounced impacts observed in cases of recurrent episodes. Malnutrition can exacerbate diminished human performance, hinder physical growth, and retard cognitive development, and it is concomitant with increased frequency, duration, and severity of diarrhoeal events. According to National Health Family Survey-5 (2019-21) the prevalence of children under 5 years who are stunted (height-for-age): 35.5%, wasted (weight-for-height): 19.3% and underweight (weight-for-age): 32.1%.[6]

Malnutrition precipitates immunodeficiency, thereby augmenting vulnerability to infections, including diarrhoea. Conversely, diarrhoea induces malnutrition via mechanisms such as diminished appetite, reduced caloric intake, nutrient depletion, and impaired nutrient absorption.[7] The interrelationship between diarrhoea and malnutrition is intricately linked to factors related to water, sanitation, and hygiene, albeit through distinct pathophysiological mechanisms.[8,9]

Diarrhoeal diseases lead to severe malnutrition and dehydration. Recurrent diarrhoeal episodes, infections, and inadequate hygiene practices can exacerbate these outcomes. Essentially, each diarrhoeal episode exacerbates nutritional deficits and fluid loss, thereby intensifying the severity of both malnutrition and dehydration. The study has been elucidated in view of paucity of literature in our area.

### *Aims and objectives*

Aims and objectives were: to identify and describe the demographic profile of malnourished children who experience diarrhoea, including age, sex, birth order and immunisation status; and to evaluate the impact of demographic variables on the severity of diarrhoea in malnourished children.

## METHODS

The present observational study was carried out in outpatient department as well as inpatient department in department of pediatrics at Acharya Shri Chander College of Medical Sciences and Hospitals after obtaining ethical permission from institution with reference no. ASCOMS/IEC/ 2024/Meeting-II/FM/15, over a period of six months, w.e.f. 01 January 2024 to 31 June 2024. A total of 260 malnourished children were included in the study after obtaining the informed consent from their parents/guardians.

### *Inclusion criteria*

Malnourished children of 6 months to 5 years were included.

### *Exclusion criteria*

Study subjects whose parents/guardians refused to participate; study subjects with congenital defects; children with renal disease; children with any neurological problem; and children with endocrine disease were excluded.

A detailed history including antenatal, natal and postnatal history, date of birth, gender, birthweight, length, gestational weeks (<37 weeks, 37–42 weeks, and ≥42 weeks), normal delivery or caesarean delivery, maternal age ≥ 35 years (yes or no), multiple birth (yes or no), feeding practices (breastfeeding, complementary feeding), immunization history, bowel and bladder habits, hygiene and sanitation history, nutritional status, Feeding habits, grading of Indian Academy of Pediatrics (IAP) classification of malnutrition, type of diarrhoea and assessment of dehydration status was collected and a thorough physical examination including general examination, anthropometric measurements includes head circumference, height/length, weight and mid arm upper circumference and systemic findings of all the study subjects were collected with the help of a structured clinical proforma.

The IAP classification of malnutrition is based on weight for age as a percentage of the expected weight for a given age. It classifies malnutrition in children into different grades - normal: weight is 80% or more of the expected weight for age; grade I (mild malnutrition): weight is between 71% to 80% of the expected weight for age; grade II (moderate malnutrition): weight is between 61% to 70% of the expected weight for age; grade III (severe malnutrition): weight is between 51% to 60% of the expected weight for age; and grade IV (very severe malnutrition): weight is 50% or less of the expected weight for age.

After taking informed consent, the assessment was done in a separate and quiet room with plenty of light. The room temperature was set at around 25 °C while the babies were

awake and quiet. The collected data was recorded in Microsoft excel sheet and statistical analysis was done with the help of statistical package for the social sciences (SPSS) version 21.0.

## RESULTS

In our study out of 260 malnourished children of age group 6 months to 5 years, 125 had diarrhoeal disease in which 76 (60.8%) were male and 49 (39.2%) were females with male to female ratio was 1.55:1 as shown in table 1 and figure 1 and majority of the study subjects were in the age group of 1-2 years (60%), followed by 6-12 months (24%), followed by 2-5 years (16%). Out of 125 malnourished children, 93 children (74.4%) were delivered in Institution including government and private hospitals and 32 children (25.6%) were delivered at home. Majority of malnourished children were either second or third in birth order (42.4%) followed by first order (34.4%) and only 23.2% were birth order fourth or above. There were 90 children (72%) who were immunised till date and rest 35 children (28%) have had either missed or not received on time their vaccination.

**Table 1: Demographic profile and immunization status of malnourished children.**

| Variables | Frequency (%) |
|---|---|
| **Age (years)** | |
| 6-12 months | 30 (24) |
| 1-2 | 75 (60) |
| 2-5 | 20 (16) |
| **Gender** | |
| Male | 76 (60.8) |
| Female | 49 (39.2) |
| **Place of birth** | |
| Institutional delivery | 93 (74.4) |
| Home delivery | 32 (25.6) |
| **Birth order** | |
| 1st order | 43 (34.4) |
| 2/3rd order | 53 (42.4) |
| 4th or above | 29 (23.2) |
| **Immunization status** | |
| Immunized till date | 90 (72) |
| Missed vaccination | 35 (28) |

Table 2 represents that only 20 children (16%) have diarrhoeal disease who were given Early introduction of breastfeed and 105 children (84%) were given breast feed after one hour. Exclusive breastfeeding had least chance of diarrhoea, only 5 children (4%) were having diarrhoeal disease, 72 children (57.6%) were on only formula feed and 28 children (22.4%) were on mixed feed and 20 children (16%) were given only cow or goat milk. There were 25 children (20%) who had not started complementary feeding and 55 children (44%) who were given complementary feeding before one year of age and 45 children (36%) were given complementary feeding after one year of age. Home based complementary feeding was given to 75 children (60%), 18 children (14.4%) were given only commercial baby food and rest 32 children (25.6%) were on both types of complementary feeding.

**Table 2: Feeding habits.**

| Feeding practices | Number (%) |
|---|---|
| **Initiation of breastfeed** | |
| Within one hour | 20 (16) |
| After one hour | 105 (84) |
| **Type of milk** | |
| Exclusive breastfed | 5 (4) |
| Formula feed | 72 (57.6) |
| Formula + breastmilk | 28 (22.4) |
| Goat/cow milk | 20 (16) |
| **Complementary feeding** | |
| Not yet started | 25 (20) |
| Started before 1 year | 55 (44) |
| Started after 1 year | 45 (36) |
| **Type of complementary food** | |
| Home based preparations | 75 (60) |
| Commercial baby food | 18 (14.4) |
| Combination of home and commercially prepared | 32 (25.6) |

Table 3 shows that out of 76 male malnourished children who had diarrhoea, 52.6% were found to have grade II IAP classification of malnutrition followed by 21%, 18.4% and 8% have grade III, grade I and grade IV respectively whereas out of 49 malnourished female children who had diarrhoea, 34.7% were having grade I IAP classification of malnutrition whereas grade II and grade III were found almost similar numbers 26.5% and 24.5% respectively and 14.3% had grade IV IAP classification.

**Table 3: IAP classification of malnutrition.**

| Gender | Grade I (%) | Grade II (%) | Grade III (%) | Grade IV (%) |
|---|---|---|---|---|
| **Male** | 14 (18.4) | 40 (52.6) | 16 (21) | 6 (8) |
| **Female** | 17 (34.7) | 13 (26.5) | 12 (24.5) | 7 (14.3) |

It was found that out of 125 cases of malnutrition with diarrhoea, 40 (32%) had acute gastro-enteritis, followed by 38 (30.4%) had acute diarrhoea, followed by 30 (24%) had acute dysentery and rest 17 (13.6%) had chronic diarrhoea as shown in Table 4.

It was found that out of 260 malnourished children of age group 6 months to 5 years, 125 had diarrhoeal disease in which 75 (60%) had no dehydration, 35 (28%) had some dehydration followed by only 15 (12%) had severe dehydration as shown in Table 5.

It was found that out of 260 malnourished children of age group 6 months to 5 years, 125 had diarrhoeal disease in which 80 children (64%) have features of malnutrition.

**Table 4: Malnutrition with type of diarrhea.**

| Malnutrition with diarrhoea | No. | Percentage |
|---|---|---|
| **Acute gastroenteritis** | 40 | 32 |
| **Acute diarrhea** | 38 | 30.4 |
| **Acute dysentery** | 30 | 24 |
| **Chronic diarrhoea** | 17 | 13.6 |

**Table 5: Dehydration status.**

| Type of dehydration | No. | Percentage |
|---|---|---|
| **No dehydration** | 75 | 60 |
| **Some dehydration** | 35 | 28 |
| **Severe dehydration** | 15 | 12 |

Vitamin D deficiency, 35 children (28%) have features of vitamin A deficiency and 24 children (19.2%) have vitamin B complex deficiency features like glossitis, angular cheilosis, stomatitis etc. and 5 children (4%) show changes in skin as shown in Table 6.

**Table 6: Clinical features.**

| Clinical features | No. | Percentage |
|---|---|---|
| **Vitamin D deficiency** | 80 | 64 |
| **Vitamin A deficiency** | 35 | 28 |
| **Vitamin B complex deficiency** | 24 | 19.2 |
| **Skin changes** | 5 | 4 |

Table 7 shows that out of 260 malnourished children of age group 6 months to 5 years, 125 had diarrhoeal disease in which 13 children (10.4%) have respiratory tract signs in the form of crypts and wheeze and on abdominal examination, hepatomegaly was seen in 20 children 16% and 10 children (8%) were having splenomegaly. Cardiovascular system examination was almost within normal range.

**Table 7: Clinical examination.**

| Systematic examination | No. | Percentage |
|---|---|---|
| **Respiratory tract signs** | 13 | 10.4 |
| **Cardiovascular system examination** | WNL | |
| **Hepatomegaly** | 20 | 16 |
| **Splenomegaly** | 10 | 8 |

## DISCUSSION

In our study out of 260 malnourished children of age group 6 months to 5 years, 125 had diarrhoeal disease in which 76 (60.8%) were male and 49 (39.2%) were females with male to female ratio was 1.55:1. In the study conducted by Jarman et al also demonstrated an increased incidence of diarrheal illness in boys compared with girls.[10]

Our study shows majority of the malnourished children were in the age group of 1-2 years (60%), followed by 6-12 months (24%), followed by 2-5 years (16%). Similar study conducted by Avachat shows the preponderance of diarrhoeal cases in children aged 13 to 24 months, constituting 29.6% of the affected cohort.[11] This finding aligns with the results of Negi's study, which reported a prevalence of 60.24% among children aged 10–25 months.[12] Conversely, Lal's research, conducted in urban slums, identified that 42.6% of diarrhoeal cases were among children aged 6 to 12 months, with only 26.4% occurring in those older than one year and in the study by Ahmed et al diarrhoea cases were highest in the age group of 6–11 months (49.1%).[13,14]

The etiological mechanisms through which diarrhoea may precipitate malnutrition encompass: the depletion of nutrients via faecal excretion, the impaired absorption of nutrients concomitant with diarrhoea, and the reduction in food consumption attributable to diminished appetite and restrictive feeding practices. Conversely, malnutrition may exacerbate diarrhoea by attenuating immune function, thereby increasing susceptibility to infectious agents. Consequently, the discernible relationship between malnutrition and diarrhoea in a given study is contingent upon these variables.

In our study among 125 malnourished children, only 20 children (16%) had diarrhoeal disease who were given Early introduction of breastfeeding within one hour after delivery and 105 children (84%) were given breast feed after one hour. Exclusive breastfeeding had least chance of diarrhoea, only 5 children (4%) were having diarrhoeal disease. Empirical evidence suggests that optimal breastfeeding practices are protective against diarrhoeal disease in populations.[15] Similar study by Meshram and Arifeen also found that early introduction and exclusive breastfeeding are protective against diarrhoea.[16,17] Our study also concludes that the introduction of complementary foods to infants correlates with an elevated incidence of diarrheal episodes. This phenomenon is likely attributable to factors such as potential contamination of the complementary food, suboptimal hygiene practices, and insufficient sanitary measures in food storage and preparation.[18]

### *Limitations*

The limitation of this study was a small sample size, single centre study and short study period.

## CONCLUSION

The present study concluded that the malnutrition engenders diarrhoeal manifestations through a variety of mechanisms, while diarrhoea, in turn, exacerbates the degradation of nutritional status. Moreover, 13.6% of

cases of diarrhoea becomes chronic has significant implication and highlights the need of early intervention and effective management strategies to prevent acute cases from developing into chronic. Thus, the demographic profile of diarrhoea in malnourished children reveals a complex interplay between nutritional deficiencies and the prevalence of gastrointestinal illnesses. The data underscores that malnutrition significantly heightens the vulnerability of children to diarrhoeal diseases, which in turn exacerbates their nutritional deficits, creating a vicious cycle. Addressing this issue requires a multifaceted approach that includes improving nutritional status, enhancing access to clean water and sanitation, and implementing targeted health interventions. Such measures are crucial for breaking the cycle of malnutrition and diarrhoea, thereby improving health outcomes and quality of life for affected children.

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