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Research Article

# Risk Factors for Persistent Diarrhea in Children Under Five Year of age in a Tertiary Care Institute of Haryana

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ABSTRACT

***Introduction:*** Diarrheal diseases rank as the second most common cause of mortality in children below the age of five. According to the World Health Organization, persistent diarrhea is defined as diarrhea that persists for a duration of more than fourteen days. Persistent diarrhea makes up only 10 % of all cases of diarrhea but up to 35 % of mortality in children under five years of age. Sixty percent of PD cases appear in the first six months of life, and 90 percent in the first year Case fatality rate for persistent diarrhea is higher (14%) as compared to the acute diarrhea (0.7%) **Aim**: To assess risk factors associated with persistent diarrhea in children under five years of age.**Material and Methods**: This prospective case control study was carried out in the department of Paediatrics at a tertiary care institute of Haryana from April 2022 to April 2023. A total of 70 cases of persistent diarrhea among children < 5 years of age fulfilling the inclusion criteria and exclusion criterion and equal number of controls with acute diarrhea were enrolled in the study after taking written informed consent from one of the parent. Detailed history and clinical examination was carried. All the study subjects were given treatment as per standard guidelines. **Results**:. Infants of age between 1 months and 1 year constituted about 55.71% of total cases of persistent diarrhea, 1-3 years constituting 37.14% cases of persistent diarrhea and 3-5 years of age accounts for rest of 7.15 % of cases. Study subjects showed male predominance with 55.7% male and 44.3% female children. Protein energy malnutrition, parenteral infection, exclusive breast feeding and use of unsafe drinking water all were found to be independent risk factors associated with persistent diarrhea. In total five death were reported in cases of persistent diarrhea and rest 65 patients were discharged and in controls all seventy patients were discharged without any mortality. The overall mortality rate of cases of persistent diarrhea was 7.14%.**Conclusion**: Persistent diarrhea is substantial health problem in children under 1 year of age (55.71%). Lack of breast feeding, irrational use of antibiotics, parenteral infections, protein energy malnutrition and use of unsafe drinking water were the independent risk factors for persistent diarrhea occurrence.

## INTRODUCTION

Diarrhoeal diseases rank as the second most common cause of mortality in children below the age of five. According to the ICD-10, diarrhea is a disorder that can manifest in various unique forms[1]. According to the World Health Organization (WHO), persistent diarrhea [PD] is defined as diarrhea that persists for a duration of more than 14 days and accounts for 3 % to 20% of all acute diarrhea cases. Case fatality rate for persistent diarrhea is higher (14%) as compared to the acute diarrhea (0.7%).[2] Within low- and middle-income countries (LMICs), there is poor understanding of appropriate care-seeking behaviour and case management. According to WHO, persistent diarrhea makes up only 10 % of all cases of diarrhea but up to 35 % of mortality in children under 5 years of age. Community-based studies have demonstrated the occurrence of seven instances of persistent diarrhea annually for every one hundred children aged four years or

or younger [2] Sixty percent of PD cases appear in the first six months of life, and 90 percent in the first year [3]

The National Family Health Survey statistics indicate the prevalence of diarrhea among children in India has increased from 9 % in 2016 to 9.2 % in 2020 [4]. The death rate due to childhood diarrhea in Uttar Pradesh and Assam is higher than in most other states in India.[5]. PD is commonly associated with impaired mucosal regeneration and reduced gastrointestinal digestion and absorption capacity. [6,7]. These prolonged episodes of diarrhea are crucial as they are linked to long-term repercussions.

This study was conducted in Nuh district of Haryana, most underdeveloped district in India as per NITI Aayog report of year 2018. The under-5 mortality rate in Nuh district is significantly elevated, as indicated by the 2019 Sample registration system. The reasons might be low socioeconomic level, a poor literacy rate excessive population density and conventional traditions. This research was intended to identify the risk factors associated with persistent diarrhea and develop strategies to reduce the impact on public health.

**METHODS**

This study was a prospective case-control study conducted from April 2022 to April 2023 in a tertiary care institute of Haryana after approval from institutional ethics committee. Any child of age between 1 month to 5 years of age with prolonged episodes of diarrhea lasting over 14 days was included in the study. Exclusion criterion included patients having chronic or recurrent diarrhea with a gradual and subtle beginning and incidence of measles in children older than 9 months within the past 3 months.

A total of 70 patients with persistent diarrhea and an equal number of patients with acute diarrhea as control were recruited in the study. The parents, typically the mother, were interviewed to obtain a comprehensive background. Details like age, sex, socioeconomic status water consumption, and specific facts about the diarrhoeal episode like duration, frequency, consistency, presence of blood and or mucus were recorded in proforma.

Further details were elicited about feeding methods, specifically breastfeeding and bottle feeding, including the technique and the utilization of a feeding container, use of antibiotics, and immunization status. A comprehensive physical examination was carried out. Anthropometry assessments were conducted to measure weight, height, and mid-arm circumference and categorize individuals accordingly as per WHO classification of malnutrition. Additionally, the patients were evaluated for indications of systemic illness such as lower respiratory tract infection (LRTI), tuberculosis (TB), or urinary tract infection (UTI). Baseline investigations were conducted on all patients in both the groups including serum electrolytes, renal function test, serum protein, serum albumin, and urine routine microscopy. Both the groups received treatment as per standard protocols. according to the conventional treatment procedure. The outcomes were characterized as either discharge or death in both cases.

Statistical analysis: The data was analysed with SPSS, version 25. An analysis of risk factors was conducted in both the groups. Odds ratio for each risk factor was estimated by univariate analysis using chi-square method. Fisher's exact test was used to determine statistical significance, with a threshold of a p-value less than 0.05.

**RESULTS**

A total of 70 cases of persistent diarrhea and equal number of controls with acute diarrhea were analyzed. Most of cases (39/70, 55.7%) were under 1 year of age. Male and Female children constituted 55.71% and 44.29% of persistent diarrhea respectively in cases and male and female children constituted 57.14% and 42.86 % respectively in controls (Table 1).

Pneumonia, UTI and Septicemia were observed in 40.00%, 15.71% and 7.14% of total cases of persistent diarrhea. Five deaths were observed in cases with persistent diarrhea and the remaining sixty five patients survived and discharged under stable condition. All 70 patients in control group were discharged without any fatalities. Three deaths were in children of age group <1 year and two deaths were in age group of 1-3 years. Therefore, the cumulative fatality rate for instances of persistent diarrhea was 7.14%.

Nutritional status categorization was done on the basis of WHO classification and was found that MAM (moderate acute malnutrition) was observed in 20% cases and 15.71% in controls. SAM (severe acute malnutrition) was observed in 65.71% cases and 44.29% in control. Under nutrition was significantly higher ($p < 0.0010$) in persistent diarrhea cases than control group. Nutrition status is depicted table no. 02. Persistent diarrhea cases were 4 times more likely to be with under nutrition when compared to children with acute watery diarrhoea (OR 4.00, 95% CI 1.76-9.11).

Children with persistent diarrhea were 2 times more likely to be exposed to irrational antibiotic therapy when compared to children with acute watery diarrhea (OR 2.13, 95% CI 1.05-4.33).

Lack of exclusive breast feeding was present in higher proportion in children with persistent diarrhea (64/70,91.43%) when compared to children with acute watery diarrhea (41/70, 58.57%). Children with persistent diarrhea were seven times more likely to be not exclusively breast fed when compared to children with acute watery diarrhoea. [OR (95% CI): 7.54 (2.88-19.75)].

Parenteral infection was present in higher proportion in children with persistent diarrhea (45/70, 64.29%) when compared to children with acute watery diarrhea (23/210, 32.85%). Persistent diarrhea cases were about three times more likely to be with parenteral infections when compared to children with acute watery diarrhea [OR (95% CI): 3.68 (1.83-7.40)]

**Table 1: Demographic profile of the study**

| | Age | Cases (n=70) | % of cases | Control (n=70) | % of controls |
|---|---|---|---|---|---|
| Age | >1 month - 1 year | 39 | 55.7 % | 41 | 58.57% |
| | >1 year - 3 years | 26 | 37.14% | 25 | 35.7% |
| | >3 year - 5 years | 5 | 7.15% | 4 | 5.71% |
| Sex | Male | 39 | 55.71% | 40 | 57.14% |
| | Female | 31 | 44.29% | 30 | 42.86% |

**Table 2: Distribution of cases and controls on basis of nutritional status**

| Nutritional Status | Cases (n=70) | Percentage | Controls (n=70) | percentage | *P* VALUE |
|---|---|---|---|---|---|
| Normal | 10 | 14.29% | 28 | 40% | |
| MAM | 14 | 20.00% | 11 | 15.71% | |
| SAM | 46 | 65.71% | 31 | 44.29% | |
| Under-nourished (SAM +MAM) | 60 | 85.71% | 42 | 60.00% | <0.0010 |

Use of unsafe drinking water was present in higher proportion in children with persistent diarrhea (60/70, 85.7%) when compared to children with acute watery diarrhoea. (50/70, 71.43%). Children with persistent diarrhea were about two times more likely to consuming unsafe drinking water when compared to children with, acute watery diarrhea[OR (95% CI): 2.40 (1.03-5.60)].

Other risk factors which were not found to be significant by univariate analysis were containers used for feeding [OR (95% CI); 1.73 (0.80 -3.76)] dysenteric stool [OR (95% CI); 2.05(0.77-5.50), Persistence of dehydration>24 hours [OR (95% CI; 1.3409(0.561-3.201)] and, immunization in appropriate for age [OR (95% CI); 1.57 (0.53-4.69)].

Comparison of Risk factors for persistent diarrhea in children under five years of age with control age group by univariate analysis is depicted in Table no. 03

**Table 3: Comparison of Risk factors for persistent diarrhea in children under 5 years of age with control age group – univariate analysis**

| **Risk Factor** | | **Cases** | | Control | | ***P* value** | ****OR-Odds ratio (95% CI)** |
|---|---|---|---|---|---|---|---|
| | | **N** | **%** | **N** | **%** | | |
| Nutritionalstatus | Normal | 10 | 14.3 | 28 | 40 | **<0.0010** | 4.00 (1.76-9.11) |
| | Under nourished | 60 | 85.7 | 42 | 60 | | |
| Irrational Antibioticuse | Present | 51 | 72.86 | 39 | 55.71 | | 2.13 (1.05-4.33) |
| | Absent | 19 | 27.14 | 31 | 44.29 | **<0.0357** | |
| Exclusive breast feeding | Present | 6 | 8.57 | 29 | 41.43 | **<0.0001** | 7.54 (2.88-19.75) |
| | Absent | 64 | 91.43 | 41 | 58.57 | | |
| Parenteral infection* | Present | 45 | 64.29 | 23 | 32.85 | **<0.0003** | 3.68 (1.83-7.40) |
| | Absent | 25 | 35.71 | 47 | 67.15 | | |
| Use of unsafe drinking water | Present | 60 | 85.7 | 50 | 71.43 | **<0.0427** | 2.4 (1.03-5.60) |
| | Absent | 10 | 14.3 | 20 | 28.57 | | |
| Container used for feeding | Cup and Spoon or 'Paladai' | 16 | 25.00 | 22 | 38.67 | 0.1610 | 1.73 (0.80-3.76) |
| | Bottle | 48 | 75 | 38 | 63.33 | | |
| Dysentericstool | Present | 13 | 18.57 | 7 | 10 | 0.1530 | 2.05 (0.77-5.50) |
| | Absent | 57 | 81.43 | 63 | 90 | | |
| Persistence of dehydration >24 hours | Present | 14 | 20 | 11 | 7.14 | 0.5088 | 1.3409 (0.561-3.201) |
| | Absent | 56 | 80 | 59 | 92.86 | | |
| Immunization appropriate for age | Present | 6 | 8.57 | 9 | 12.85 | 0.415 | 1.57 (0.53- |

*Septicemia, pneumonia, UTI, CSOM ** OR – Odd's ratio CI – Confidence Interval

The factors which were found to be significant by univariate analysis were included for multivariate analysis. Protein energy malnutrition, parenteral infection, exclusive breast feeding and use of unsafe drinking water all were found to be independent risk factors associated with persistent diarrhea in the children studied as shown in table no. 04

**Table 04: Comparison of Risk factors for persistent diarrhea in children under 5 years of age – multivariate analysis**

| | Risk factor | SE | Df | p-value | Adjusted OR | 95 % CI | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| 1. | Protein energy malnutrition | 0.129 | 1 | **0.000** | 1.812 | 1.406 | 2.335 |
| 2. | Irrational Antibiotic use | 0.359 | 1 | **0.014** | 2.414 | 1.195 | 4.877 |
| 3. | Lack of exclusive breast feeding | 0.360 | 1 | **0.017** | 2.519 | 1.198 | 4.982 |
| 4. | Parenteral infection | 0.341 | 1 | **0.016** | 2.275 | 1.165 | 4.443 |
| 5. | Use of unsafe drinking water | 0.412 | 1 | **0.015** | 2.738 | 1.221 | 6.143 |

* OR – Odd's ratio CI – Confidence Interval

**DISCUSSION**

Research has shown that children with chronic diarrhea are at an increased risk of experiencing developmental issues and nutritional deficits[8]. The mortality rate linked to diarrheal sickness has decreased due to proper oral rehydration treatment [9].

In the current study, infants aged between 1 month and 1 year accounted for around 55.71%. Children aged between 1-3 years constituted 37.14% of chronic diarrhea. Overall, children under the age of 3 accounted for 92.85% instances of chronic diarrhea.

Consistent with our research, Ghosh et al.[4] discovered that infants aged 0–12 months and children aged 12–34 months had an odds ratio of 0.77, whereas those older than 35 months had an odds ratio of 0.34 and thus having markedly reduced occurrence of diarrhea. Our findings align with the research findings of Fuller et al, that toddlers under 1 year of age were having more instances of chronic diarrhea[10]. Our study found that 55.7% of the children were male and 44.3% were female.indicates male dominance, as demonstrated by Mbori-Ngacha and colleagues[11].

A newborn who is breastfed has a significantly lower risk of dying from diarrhea due to certain defensive elements in br-east milk such as secretary IgA, macrophages, and bifidus factor. In the present study, 91.4% of cases were given animal or artificial milk before 6 months of age. Approximately 85% of the study population consumed both cow and buffalo milk, with a preference for buffalo milk in 54.28% Absence of exclusive breast feeding in cases of persistant diarrhea was seen 91.43 % compared to those with acute watery diarrhea (58.57%). Therefore, exclusive breastfeeding up to 6 months of age was very low among our study participants.

In line with our study, Karim and colleagues demonstrated a similar finding about the absence of exclusive breastfeeding was identified as a standalone risk factor for chronic diarrhea[12]. In Alshehri et al.'s study, demonstrated higher incidence of persistant diarrhea in 26.08% of children who were bottle-fed compared to 21.70% of newborns who were breastfed[13]. In bivariate analysis, bottle feeding was found to be significantly linked with higher incidence of diarrhea related illness. Roy et al[14] found that the bottle feeding methods, presence of mucus in stool, a weight-for-age z-score (WAZ) below two, and initiation of early supplementary feeding demonstrated a robust correlation with the disease. In our study, undernutrition

was present in higher proportion in children with persistent diarrhoea (85.71%) when compared to children with acute diarrhoea (60%). MAM was observed in 20% cases of persistent diarrhoea. SAM was observed in 65.71% cases of persistent diarrhoea. malnutrition increases the risk of persistent diarrhoea as it impairs the reparative process of gut. Persistent diarrhea cases were 4 times more likely to be with protein energy malnutrition when compared to children with acute watery diarrhea [OR (95 % CI): 4.00 (1.76-9.11)]. According to Durairaj et al. also al.[15], protein-energy deficit is a significant risk factor for persistent diarrhea.

Han et al.[16] discovered that the malnourished children had a 14.4 times higher risk for persistent diarrhea compared to mal-nourished children.

Irrational use of antibiotics suppresses the normal gut flora and leads to bacterial overgrowth with pathogenic bacteria and fungi. In current study, irrational antibiotic use was present in higher proportion in children with persistent diarrhoea (72.86%) when compared to children with acute watery diarrhoea (55.71%). Children with persistent diarrhoea were 2 times more likely to be exposed to irrational antibiotic therapy when compared to children with acute watery diarrhoea (OR=2.13). Our study findings are in line with Durairaj et al.[15], irrational antibiotic use (OR- 2.414) was associated with the higher odds of persistent diarrhoea.

In our research, use of unsafe drinking water was present in higher proportion in children with persistent diarrhoea (85.7%) when compared to children with acute watery diarrhoea (71.43%). Children with persistent diarrhoea were about 2 times more likely to consuming unsafe drinking water when compared to children with, acute watery diarrhoea [OR (95 % CI): 2.40 (1.03-5.60)]. These findings are also reported in other studies by Manetu et al.[17] found that the reliance on open water sources, which are frequently polluted with faecal debris was shown to be the primary reason of the increased incidence of persistent diarrhoea. Durairaj et al.[15] associated the consumption of contaminated drinking water with persistent diarrhoea.

In current study, parenteral infection was present in higher proportion in children with persistent diarrhea (64.29 %) when compared to children with acute watery diarrhoea (32.85%). Persistent diarrhea cases were about 3 times more likely to be with parenteral infections when compared to children with acute watery diarrhoea [OR (95% CI): 3.68 (1.83-7.40)]. Durairaj et al.[15] corroborated our findings discovered that parenteral infections were a risk factor for developing diarrhea.

Mortality was observed in 5 patients (Male-2, Female–3) in our study in cases of persistent diarrhoea, which was more observed in younger children. Over-all mortality rate for persistent diarrhoea was 7.14%, this was lesser (13.6%) than that reported by Mbori–Ngacha et al.[11] Mortality rate observed by Durairaj et al.[15] in 2017 was 10% among persistent diarrhoea cases. Mortality was less in our study as compared to other studies because patients received in our study was in better condition than

other studies, only five patients were received in shock.

## CONCLUSION

Persistent diarrhea is substantial health problem in children under 1 year of age (55.71%). Lack of breast feeding, irrational use of antibiotics, parenteral infections, protein energy malnutrition and use of unsafe drinking water were the independent risk factors for persistent diarrhea occurrence.

## LIMITATION OF STUDY

The results are not generalizable as they are based on a specific population having diverse habits, beliefs, and taboos. Additional risk factors such as family type, sewage disposal system, and household environment, overcrowding, parental literacy status were not considered in the study, which may have an effect on the results of our study.

**Contribution of authors:** SY, PT and AD conceived and designed the study; SY, SHY collected the data; AD, PT and MY provided critical inputs; PT drafted the paper and analyzed the data. All authors approved the final manuscript.

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