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# FEEDING PRACTICES AND RISK OF PROLONGED DIARRHOEA AMONG INFANTS PRESENTING WITH ACUTE DIARRHOEA: A CROSS-SECTIONAL STUDY AT HAYATABAD MEDICAL COMPLEX, PESHAWAR

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## ABSTRACT

**BACKGROUND:** Suboptimal infant feeding practices adopted by caregivers are important contributors to infectious diseases, including diarrhoeal illnesses, among infants in low- and middle-income countries.

**OBJECTIVE**: To describe feeding practices among infants presenting with diarrhoeal symptoms and examine their association with household hygiene practices and the risk of prolonged diarrhoea.

**METHODOLOGY:**: This cross-sectional study was conducted from December 2024 to June 2025 in the Department of Paediatrics at Hayatabad Medical Complex, Peshawar. A total of 161 infants presenting with diarrhoeal symptoms were enrolled. Data were collected from primary caregivers using a structured questionnaire assessing feeding practices and household hygiene conditions. Statistical analysis was performed using SPSS version 27. Associations between feeding practices and prolonged diarrhoea (>7 days) were examined using chi-square tests and binary logistic regression. Odds ratios (OR) with 95% confidence intervals (CI) were calculated.

**RESULTS** :The mean age of the infants was 6.73 ± 3.27 months; 53.4% were female and 46.6% were male. Among the participants, 55.9% had diarrhoeal symptoms lasting <7 days, while 44.1% experienced prolonged symptoms (>7 days). Infants younger than six months showed significantly higher rates of prolonged diarrhoea ($p < 0.001$). Risk factors associated with prolonged diarrhoea included formula feeding (OR = 2.37; 95% CI: 1.31–3.14), consumption of home-cooked food or cow's milk (OR = 4.02; 95% CI: 2.17–7.08), and lack of vaccination (OR = 2.05; 95% CI: 1.30–3.20). Protective factors included current breastfeeding (OR = 0.05; 95% CI: 0.01–0.26) and bottle feeding (OR = 0.11; 95% CI: 0.02–0.42). Additional significant factors included non-exclusive breastfeeding, unimproved household water sources, feeding unwashed or uncooked food, use of unwashed feeding utensils, and feeding stored food ($p < 0.05$).

**CONCLUSION:** Community-based education for caregivers, especially mothers, on feeding practices, combined with improved access to safe water and sanitation, is essential to prevent diarrhoea and its complications in Peshawar and comparable settings in Pakistan.

**KEYWORDS** :infant feeding, breastfeeding, diarrhoea, acute diarrhoea, prolonged diarrheal symptoms, Household hygiene, infant care

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## INTRODUCTION

Acute diarrhoea is one of the most common infections among children, characterised by loose, watery, and frequent stools. Most cases are self-limiting and subside within a few days; however, some progress to prolonged episodes, leading to considerable morbidity and mortality. [1]

The World Health Organization (WHO) defines diarrhoea as the passage of **three or more loose or liquid stools per day** (or more frequent passage than is normal for the individual). [2] WHO classifies diarrhoea into three main clinical types: acute watery diarrhoea (lasting several hours to days, including cholera), acute bloody diarrhoea (dysentery), and persistent diarrhoea (lasting **14 days or longer**). Acute diarrhoea is typically defined as lasting up to 14 days, while persistent diarrhoea begins at ≥14 days. In the context of the current study, diarrhoeal episodes were classified as acute (<7 days duration) or prolonged (>7 days duration) to examine factors associated with early persistence beyond the typical acute phase.

According to WHO estimates, diarrhoea remains the third leading cause of mortality among children under five years of age, accounting for approximately 0.5 million deaths annually, with 1.7 billion cases occurring worldwide each year.[3] Among common causes, rotavirus infections account for 0–30% of cases, based on a systematic review from thirty countries.[4] In Pakistan, key contributing factors to diarrhoeal diseases include unsafe drinking water, poor management of childhood illnesses, inadequate breastfeeding practices, and improper rehydration in children.[5] Diarrhoeal disease is consistently more prevalent in low- and lower-middle-income countries. For example, a study

from Ethiopia reported a 17.6% prevalence among children under five, with significant predictors including age 12–23 months (OR = 16.64) and water shortage (OR = 1.5), while vaccination status and health insurance were protective (OR = 0.5). [6]

In addition to sociodemographic characteristics, feeding practices significantly influence diarrhoea prevalence. Enteral nutrition, high-fibre feeds, the number of under-five children in the family (OR = 2.20), and age under two years (OR = 4.97) have been identified as risk factors, whereas breastfeeding practices and parental education level are protective. [2-7]

In the regional context of Pakistan, particularly in areas like Khyber Pakhtunkhwa, factors such as limited health awareness, low maternal literacy rates, rural predominance, and unimproved hygiene services place infants at elevated risk of diarrhoea and its prolongation. Despite global and some national evidence linking suboptimal feeding to diarrhoeal burden, there is a paucity of facility-based studies from tertiary care settings in northern Pakistan examining the specific association between household feeding practices, hygiene behaviours, and the occurrence of prolonged (vs. acute) diarrhoea in infants under one year. This gap hinders the development of targeted, context-specific interventions to reduce prolonged episodes and related complications. Therefore, the current study aimed to determine the occurrence of acute versus prolonged diarrhoea and its association with household feeding practices among infants under one year of age presenting at Hayatabad Medical Complex, Peshawar.

## METHODOLOGY

The study enrolled n=161 participants, based on the G-power sample size calculator. With an effect size of 1.5, df=186 and the reported power (1-β) =0.99, it is affirmed that the current sample size was justified for evaluating the difference between the two groups of diarrheal symptoms, acute symptoms versus prolonged symptoms. Acute symptoms were termed as the diarrheal symptoms of less than 7 days, and prolonged symptoms were the symptoms of more than a week. Feeding practices among the infants carried out by mothers or caregivers at home were evaluated. The G-power sample size calculator affirmed that the calculated sample was enough to differentiate among the study variables.

Children were included if they were accompanied by their mothers (or primary caregivers able to report home feeding practices) and met the case definition of diarrhoea: ≥3 watery stools per day for 7 days, as reported by the caregiver. Diarrhoea was classified as **acute** if symptoms lasted <7 days and **persistent** if >14 days (with cases of 7–14 days duration noted separately where relevant). Exclusion criteria included suspected systemic illness, chronic disease, or requirement for intensive care.

Verbal informed consent was obtained from caregivers following a detailed briefing using a participant information sheet. This sheet outlined the study aims, objectives, required information (child's clinical and sociodemographic details), and potential benefits to healthcare. Written consent was not sought due to the high prevalence of illiteracy among caregivers. Enrolled infants underwent routine pediatric evaluation, including history of neonatal complications, feeding practices, immunisation status, developmental milestones, and family history (e.g., number of children in the household). Physical examination included measurement of weight, length/height, head circumference, and vital signs (temperature, heart rate, oxygen saturation, respiratory rate).

Dehydration status was assessed using WHO criteria, including sunken eyes, dry mouth/oral mucosa, skin turgor (skin pinch test), and lethargy. Clinical management followed consultant recommendations and standard protocols. Feeding practices at home were assessed via a structured questionnaire adapted from previously published studies on risk factors for childhood diarrhoea. The questionnaire was pilot-tested on 30 non-study participants. Internal consistency was evaluated using Cronbach's alpha in SPSS version 27, yielding a reliability coefficient of 0.817. Primary outcomes included descriptive patterns of feeding practices, their association with household hygiene practices, and the risk of diarrhoea (acute/persistent).

Data were analysed using SPSS version 27. Normality of continuous variables (infant age, number of children under 5 years in the household, maternal age) was assessed using appropriate tests (e.g., Shapiro-Wilk). Non-normally distributed variables were summarised as median and interquartile range (IQR); categorical variables were reported as frequencies and percentages. Associations were examined using the chi-square test for categorical variables and odds ratios (OR) with 95% confidence intervals for risk estimation. A p-value <0.05 was considered statistically significant.

Ethical approval with reference no. 2349 was obtained from the Ethical Review Board of Hayatabad Medical Complex, Peshawar, Pakistan, on 20/12/2024.

## RESULTS

Among the 161 infants enrolled in this facility-based study, 55.9% experienced acute diarrheal symptoms lasting less than 7 days, while 44.1% had prolonged symptoms exceeding 7 days. The mean age of the participants was 6.73 ± 3.27 months, with 47.2% aged below 6 months and 52.8% aged 6 months or older. Sociodemographic characteristics of the infants and caregivers, along with household hygiene and infant care practices, are shown in Table 1.

**Table 1: Descriptive statistics of sociodemographic, household characteristics and feeding practices**

| Variables | Mean | Frequencies | Percentages |
|---|---|---|---|
| **Age** | 6.73±3.27 months | | |
| **Below 6 months** (birth - 5 months) | | 76 | 47.2 |
| **Above 6 months** (6 - 12 months) | | 85 | 52.8 |
| **Age of Mother** | 32.0±8.36 years | 161 | 100 |
| **Gender** | Male | 75 | 46.6 |
| | Female | 86 | 53.4 |

**Table 2: Sociodemographic, household, and feeding/hygiene characteristics of infants with diarrhoea (n = 161) and their association with prolonged diarrhoea (>7 days).**

| Variables | Categories | Frequencies (n) | Percentages (%) | p-value (chi-square for association with diarrhoea) |
|---|---|---|---|---|
| **Duration of Diarrhoea** | Less than a week (<7 days, acute) | 90 | 55.9 | |
| | More than a week (>7 days, prolonged) | 71 | 44.1 | (outcome variable) |
| **Birth Order** | First born | 43 | 26.7 | 0.329 |
| | Second | 52 | 32.3 | |
| | Third | 45 | 28.0 | |
| | Fourth or above | 21 | 13.0 | |
| **Currently Breastfeeding** | Yes | 90 | 55.9 | <0.001* |
| | No | 71 | 44.1 | |
| **Current Feeding Status** | Breastfeeding only | 52 | 32.3 | <0.001* |
| | Breastfeeding and formula | 38 | 23.6 | |
| | Home-cooked food & or cow's milk | 71 | 44.1 | |
| **Breastfeeding History in First 6 Months** | Exclusively breastfed (EBF) | 113 | 70.2 | <0.001* |
| | Not exclusively breastfed | 48 | 29.8 | |
| **Prelacteal Feeding** | Yes | 133 | 82.6 | 0.528 |
| | No | 28 | 17.4 | |
| **Residence** | Rural | 68 | 42.2 | 0.438 |
| | Urban | 93 | 57.8 | |
| **Toilet in Household** | Not improved | 73 | 45.3 | 0.338 |
| | Improved | 88 | 54.7 | |
| **Source of Household Drinking Water** | Improved water source | 84 | 52.2 | <0.001* |
| | Not an improved water source | 77 | 47.8 | |
| **Preparation of Infant Food** | Combined with family | 119 | 73.9 | 0.213 |

| | | | | |
|---|---|---|---|---|
| | Separate | 42 | 26.1 | |
| **Feeding Method** | Breast | 89 | 55.3 | <0.001* |
| | Cup | 19 | 11.8 | |
| | Spoon | 19 | 11.8 | |
| | Hand | 18 | 11.2 | |
| | Bottle | 16 | 9.9 | |
| **Feeding Unwashed Food** | Yes | 88 | 54.7 | <0.001* |
| | No | 73 | 45.3 | |
| **Feeding Uncooked Food** | Yes (in breastfeeding context) | 90 | 55.9 | <0.001* |
| | Yes (other contexts) | 49 | 30.4 | |
| | No | 22 | 13.7 | |
| **Feeding in Washed Utensils** | Yes | 68 | 42.2 | 0.317 |
| | No | 93 | 57.8 | |
| **Method of Washing Utensils** | Only with water | 91 | 56.5 | <0.001* |
| | With soap and water | 70 | 43.5 | |
| **Feeding Stored Food** | Yes | 89 | 55.3 | <0.001* |
| | No | 72 | 44.7 | |
| **Semi-solid/Soft Food Introduction at 6 Months** | Introduced (before or at 6 months) | 99 | 61.5 | <0.001* |
| | Not introduced | 62 | 38.5 | 0.021* |
| **Vaccination Status** | Not vaccinated | 10 | 6.2 | |
| | Under vaccinated | 72 | 44.7 | |
| | Fully vaccinated | 79 | 49.1 | |
| **Primary Caregiver** | Mother | 145 | 90.1 | 0.767 |
| | Father | 10 | 6.2 | |
| | Other family member | 6 | 3.7 | |
| **Education Status of Mother** | Illiterate | 58 | 36.0 | 0.202 |
| | Primary schooling | 56 | 34.8 | |
| | Middle to matriculation | 20 | 12.4 | |
| | Intermediate or graduation | 21 | 13.0 | |
| | Graduated from religious institute | 6 | 3.7 | |
| **Mother's Working Status** | Housewife | 147 | 91.3 | 0.085 |
| | Part-time employment | 5 | 3.1 | |
| | Full-time employment | 4 | 2.5 | |
| | Self-employed | 5 | 3.1 | |

| | | | | |
|---|---|---|---|---|
| **Monthly Income of Family** | Lower income | 138 | 85.7 | 0.091 |
| | Middle income | 12 | 7.5 | |
| | High income | 11 | 6.8 | |
| **Number of Children Under Five in Family** | None | 43 | 26.7 | 0.486 |
| | One | 52 | 32.3 | |
| | Two | 45 | 28.0 | |
| | Three or more | 21 | 13.0 | |

Chi-square analyses demonstrated significant associations between several factors and prolonged diarrhoeal symptoms (>7 days). Infants aged <6 months had markedly higher rates of prolonged diarrhoea (81.7%, 58/76) compared with those aged ≥6 months ($p < 0.001$). An independent t-test revealed a borderline difference in maternal age between the acute and prolonged diarrhoea groups ($p = 0.049$), but Cohen's $d = –0.078$ indicated a very small and clinically negligible effect size.

Non-exclusive breastfeeding in the first 6 months ($p < 0.001$) and lack of current breastfeeding ($p < 0.001$) were strongly associated with prolonged symptoms. Household and feeding hygiene practices also showed highly significant associations with prolonged diarrhoea, including use of an unimproved drinking water source (97.2% of prolonged cases, 69/71; $p < 0.001$), feeding stored food ($p < 0.001$), washing feeding utensils with water only (without soap; 61.5% of prolonged cases, 56/91; $p < 0.001$), and introduction of semi-solid or soft foods ($p < 0.001$). Notably, feeding uncooked food was significantly associated with acute diarrhoea (<7 days) rather than prolonged symptoms ($p < 0.001$).

No significant associations with prolonged diarrhoea were found for infant sex ($p = 0.073$), rural versus urban residence ($p = 0.438$), type of household toilet ($p = 0.338$), washing feeding utensils (yes/no; $p = 0.317$), method of infant food preparation (combined with family vs separate; $p = 0.213$), or prelacteal feeding ($p = 0.528$), as shown in Table 2.

**Table 3: Binary Logistic regression for the estimation of risk in household and feeding practices**

| Variables | Odds Ratio | Confidence Limits | Significance |
|---|---|---|---|
| **Birth order** | 1.50 | 0.66-3.38 | 0.329 |
| **Breastfeeding and Formula Milk** | 2.37 | 1.31-3.14 | 0.023* |
| **Home-cooked food or cow milk** | 4.02 | 2.17-7.08 | 0.012* |
| **Not vaccinated infants** | 2.05 | 1.30-3.20 | 0.021* |
| **Caregiver at Home** | 0.88 | 0.22-3.30 | 0.067 |
| **Mother's education status** | 1.19 | 0.91-1.56 | 0.202 |
| **Breastfeeding as a feeding method** | 0.05 | 0.01-0.26 | <0.001* |
| **Feeding by Cup** | 0.91 | 0.65-1.28 | 0.02* |
| **Feeding by Bottle** | 0.11 | 0.02-0.42 | <0.001* |
| **Mothers working status** | 0.84 | 0.13-5.18 | 0.085 |

Binary logistic regression analysis identified several independent predictors of prolonged diarrhoeal symptoms (>7 days). Compared with exclusively breastfed infants (reference category), those receiving breastfeeding supplemented with formula milk had significantly higher odds of prolonged diarrhoea (AOR = 2.37, 95% CI: 1.31–3.14; $p = 0.023$), while infants fed solely home-cooked food or cow's milk showed the strongest increased risk (AOR = 4.02, 95% CI: 2.17–7.08; $p = 0.012$). Unvaccinated infants also had elevated odds compared with vaccinated or under-vaccinated infants (AOR = 2.05, 95% CI: 1.30–3.20; $p = 0.021$).

Feeding methods were strongly protective: breastfeeding (AOR = 0.05, 95% CI: 0.01–0.26; $p < 0.001$), bottle-feeding (AOR = 0.11, 95% CI: 0.02–0.42; $p < 0.001$), and Cup feeding was significantly associated with prolonged diarrhoea among infants after adjustment for potential confounding variables. Infants who were cup-fed had higher odds of prolonged diarrhoea compared to those who were not cup-fed (adjusted odds ratio [AOR] = 1.91, 95% CI: 1.12-3.28, $p = 0.020$)., as shown in Table 3.

## DISCUSSION

Our study found prolonged diarrhoea (>1 week) in 44%, with significantly higher risk in those <6 months. Major risk factors included non-exclusive/current breastfeeding, unimproved water source, unhygienic practices (unwashed/uncooked/stored food, utensils washed only with water), early introduction of solids/semi-solids, and lack of vaccination. Exclusive and current breastfeeding, along with bottle-feeding, were strongly protective. These findings highlight the urgent need to promote exclusive breastfeeding, safe water and hygiene, timely vaccination, and delayed complementary feeding to reduce prolonged diarrhoea in infants.

A prior multi-country secondary analysis including Pakistani data reported a 16% prevalence of prolonged diarrhea (>7 days) among affected infants, with an adjusted odds ratio of 1.25 (95% CI: 1.02–1.53) for prolonged symptoms in children aged 2–12 months compared with older toddlers,[8] whereas the present facility-based study, limited to infants presenting with diarrheal symptoms at a single tertiary hospital in Peshawar, found a strong significant association between age below 6 months and prolonged diarrheal symptoms ($p < 0.001$), with 81.7% (58/76) of infants <6 months experiencing persistence beyond 7 days, and 52.8% (85/161) of all cases occurring in the 7–12 months age group; this pattern contrasts with findings from southwestern Saudi Arabia, where diarrhea occurrence was significantly associated with the 7–12 months age group (OR = 2.64, 95% CI: 1.42–4.91),[9] while no significant association emerged here between the number of children under five in the household and prolonged diarrhea ($p = 0.486$), unlike the earlier multi-site study which identified increased risk in households with three or more such children (OR = 1.54, 95% CI: 1.26–1.87; $p < 0.001$),[8] and maternal education similarly showed no significant link in the current findings ($p = 0.202$) despite prior evidence linking maternal illiteracy to elevated risk (OR = 1.45, 95% CI: 1.21–1.74; $p < 0.001$).[8]

A key finding of the current study was the significant association between lack of vaccination and prolonged diarrheal symptoms (>7 days), with an odds ratio of 2.05 (95% CI: 1.30–2.30; $p = 0.021$) among unvaccinated infants, which is consistent with evidence from China showing that rotavirus accounted for a large proportion of diarrheal cases in infants and norovirus contributed notably (e.g., 37.62% in the 6–11 months age group in certain seasons),[10] underscoring how absence of rotavirus vaccination predisposes infants to more severe or persistent infections, especially given the substantial global reduction in rotavirus-related mortality following vaccine introduction in the early 21st century;[11] additionally, use of an unimproved water source emerged as a highly significant predictor of prolonged symptoms ($p < 0.001$), aligning with a five-year Ethiopian cohort that reported a 41.75% diarrhea incidence among children under five and identified both protected (AOR = 1.50, 95% CI: 1.32–1.71) and unprotected tube well sources (AOR = 1.66, 95% CI: 1.27–2.18) as risk factors compared to piped water,[12] while improved toilet facilities present in 54.7% (88/161) of households here showed no significant association with prolonged diarrhea ($p = 0.338$), in contrast to the Ethiopian study where toilet access was protective (AOR = 0.87, 95% CI: 0.78–0.97),[12] highlighting the critical yet context-dependent role of WASH interventions in reducing diarrheal burden in resource-limited settings.

The current study found that 55.9% (90/161) of infants were currently breastfeeding, with chi-square analysis revealing a highly significant difference ($p < 0.001$) in prolonged diarrheal symptoms (>7 days) among those not currently breastfed. This protective effect was further supported by binary logistic regression identifying current breastfeeding as a strong safeguard against prolonged symptoms (OR = 0.05, 95% CI: 0.01–0.26; $p < 0.001$). These results align with evidence from Ethiopia, where non-exclusive breastfeeding was associated with increased diarrhoea risk (OR = 4.72, 95% CI: 1.16–19.13).[13] Exclusive breastfeeding (EBF) was reported in 70.2% (113/161) of infants in this cohort, exceeding some prior estimates in Pakistan, such as 63.2% in a study from Azad Kashmir and the widely cited WHO/UNICEF figure of 37.2%. Although recent national data indicate rates around 48% in recent years, with persistent barriers including social, cultural, and maternal nutrition factors, particularly in rural settings.[14,15]

Introduction of semi-solid or solid foods showed a significant association with prolonged diarrheal symptoms ($p < 0.001$). While complementary feeding is nutritionally essential beyond 6 months of age[16], the current findings do not attribute prolonged diarrhoea solely to the timely initiation of complementary foods; rather, risks likely stem from concurrent household sanitation, hygiene practices, and caregiver feeding behaviours that can introduce infections.[17] Prelacteal feeding was prevalent in 82.6% (133/161) of infants, yet chi-square testing showed no significant difference in acute versus prolonged symptoms ($p = 0.582$). Globally, prelacteal feeding affects about one in three neonates in low and middle-income countries, often linked to low maternal education, limited awareness of breastfeeding benefits, and cultural beliefs.[18,20] These patterns emphasize the need for targeted interventions to promote optimal breastfeeding and safe complementary feeding practices in high-risk settings.

With respect to current feeding practices (feeding status at the time of data collection), 32.3% (52/161) were exclusively breastfed, 23.6% (38/161) received breastfeeding with formula supplementation, and 44.1% (71/161) received only home-cooked food or cow's milk. Compared with exclusive breastfeeding, formula supplementation (OR = 2.37, 95% CI: 1.31–3.14; $p = 0.023$) and home-cooked food or cow's milk (OR = 4.02, 95% CI: 2.17–7.08; $p = 0.012$) were associated with significantly increased odds of prolonged diarrhoea. Although existing literature does not consistently identify cow's milk as an independent risk factor for diarrhoea in otherwise healthy infants,[21] the combined questionnaire item ("home-cooked food or cow's milk") captured the influence of household hygiene, food preparation practices, and caregiver behaviours, well-established contributors to foodborne diarrhoea in young children.[22]

The study was limited to infants presenting with diarrheal symptoms, which restricts the generalizability of findings to the broader infant population for predicting overall diarrhoea risk. Additional limitations include the lack of data on hospital length of stay or clinical outcomes, which could inform future investigations into the prognostic implications of household feeding practices; potential social desirability bias in self-reported hygiene behaviours; absence of laboratory confirmation of causative pathogens, precluding identification of dominant etiologic agents in this setting; and exclusive reliance on caregiver-reported information without verification from medical records, such that classification into acute (<7 days) or prolonged (>7 days) symptom groups depended entirely on parental recall.

## CONCLUSION

The findings of the current study concluded that feeding practices have a significant impact on the occurrence of prolonged diarrheal symptoms in infants. Children below the age of six months, not breastfeeding, and with an unimproved household water source, feeding by cup, feeding unwashed food, introduction of semi-solid food items, and not vaccinated, pose a significant risk of developing diarrhoea. Future studies should address these gaps through prospective designs incorporating pathogen diagnostics and objective clinical endpoints to better elucidate the mechanisms and long-term consequences of suboptimal feeding and hygiene practices in resource-limited contexts.

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