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Original Research Article

Frequency of Enteric Fever in Children Presenting with Acute Febrile Illness: A Cross- Sectional Study from The Children Hospital, Lahore

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Abstract:
Objective Background: Enteric fever remains a significant public health concern, particularly in developing countries. While its prevalence among older children is well-documented, limited data exist regarding its frequency and clinical presentation in children under two years of age presenting with acute febrile illness. ***Methods***: A cross-sectional study was conducted over six months at the Department of Pediatric Medicine, University of Child Health Sciences and The Children's Hospital, Lahore. After obtaining ethical approval and informed parental consent, children aged 6–24 months presenting with acute febrile illness were enrolled based on predefined inclusion and exclusion criteria. Clinical history, demographic data, and physical examination findings were documented. Blood samples were obtained and analysed using Bactec culture for confirmation of enteric fever. ***Results***: A total of 163 children were enrolled, with a mean age of 13.23 ± 5.05 months. Males comprised 58.3% of the cohort. Enteric fever was diagnosed in 23.3% (n=38) of participants. No statistically significant association was observed between the presence of enteric fever and variables such as age, gender, weight, duration of fever, or recent antibiotic use ($p > 0.05$). ***Conclusion***: This study demonstrates a notable frequency of enteric fever (23.3%) among children aged 6–24 months with acute febrile illness, emphasizing the need for clinical vigilance in this vulnerable population. The absence of significant demographic or clinical predictors underscores the importance of routine diagnostic evaluation to guide timely treatment.

Keywords: Acute Febrile Illness, Bactec System, Cross sectional Study, Enteric Fever, Fever

INTRODUCTION

Acute febrile illness is among the most frequent causes of pediatric healthcare visits worldwide, particularly in low- and middle-income countries where infectious diseases remain highly prevalent (Iroh Tam, Obaro, & Storch, 2016). In infants and toddlers, fever often serves as a primary indicator of illness but is rarely specific to a single cause (Barbi, Marzuillo, Neri, Naviglio, & Krauss, 2017). The wide range of potential infectious aetiologies, including viral, bacterial, and parasitic pathogens, presents a significant diagnostic challenge (Neupane, Dulal, & Song, 2021). Clinically distinguishing between these causes is difficult, as many share overlapping symptoms such as irritability, poor feeding, and general malaise (Aiemjoy et al., 2020). This diagnostic uncertainty often complicates timely and appropriate management, especially in resource-limited settings where advanced laboratory investigations may not be readily accessible.

Building on the challenges posed by undifferentiated febrile illnesses in young children, enteric fever—caused mainly by Salmonella enterica serotypes Typhi and Paratyphi—remains a major public health concern in endemic regions such as South Asia (Garrett et al., 2021). According to World Health Organization estimates, children under five years of age bear a significant portion of the global burden of typhoid fever, experiencing high rates of both morbidity and mortality (Theiss-Nyland et al., 2019). In Pakistan specifically, the disease continues to be highly prevalent, compounded by the emergence of multidrug-resistant and extensively drug-resistant strains (Qamar et al., 2025). This growing resistance further complicates treatment and underscores the urgency for improved diagnostic, preventive, and management strategies in this vulnerable population. Diagnosing enteric fever in young children, particularly those under two years of age, is associated with challenges due to its often non-specific clinical presentation (Qamar et al., 2025). Symptoms such as prolonged fever, lethargy, and gastrointestinal discomfort overlap with many other common childhood infections, making early and accurate diagnosis difficult based on clinical features alone (T. Saha et al., 2023). This challenge is further compounded in many healthcare settings where access to reliable laboratory diagnostics, such as blood culture facilities, is limited or delayed (Aiemjoy et al., 2020). As a result, clinicians frequently rely on empirical antibiotic therapy to manage febrile illnesses, which, while sometimes necessary, can contribute to the inappropriate use of antibiotics and the rising threat of antimicrobial resistance.

Early identification of enteric fever is essential to prevent serious complications and limit the spread of infection within communities. Prompt and accurate diagnosis allows for timely initiation of appropriate antibiotic therapy, which can significantly reduce the risk of severe outcomes such as intestinal perforation, hemorrhage, or prolonged illness. In young children, delayed or missed diagnoses not only increase the likelihood of these complications but also contribute to higher morbidity and mortality rates (Azmatullah, Qamar, Thaver, Zaidi, & Bhutta, 2015). Moreover, early detection helps in controlling outbreaks by enabling appropriate public health responses, including isolation measures and vaccination efforts, thereby reducing transmission in high-risk populations (Garrett et al., 2021).

Although numerous studies have investigated enteric fever in older children, there remains a notable scarcity of data focusing specifically on children under two years of age. This age group is particularly vulnerable due to their developing immune systems and unique clinical presentations, yet they are often underrepresented in research and surveillance efforts (Saigal, Gupta, & Saikia, 2021). Understanding the prevalence and clinical characteristics of enteric fever in infants and toddlers is critical for improving early diagnosis, treatment, and prevention strategies tailored to their specific needs. Addressing this gap will provide valuable insights to guide clinicians and public health policymakers in optimizing care for this high-risk population. By better understanding its prevalence and associated factors, healthcare providers can make more informed decisions regarding timely treatment and reduce unnecessary antibiotic use. This will ultimately contribute to better disease control and improved health outcomes in vulnerable pediatric populations.

METHODOLOGY:

This cross-sectional study was conducted in the Department of Pediatric Medicine at The University of Child Health and The Children's Hospital, Lahore. The research spanned a period of six months, from June 28, 2023, to December 28, 2023, following approval from the institutional research and ethics committee. Written informed consent was obtained from the parents or legal guardians of all participants before enrolment. The study population comprised children presenting with acute febrile illness to the pediatric outpatient and inpatient departments during the study period.

A sample size of 100 was initially calculated using the WHO sample size calculator, assuming a 95% confidence level, an 8% margin of error, and an estimated prevalence of enteric (typhoid) fever of 12% among children in developing countries. However, to enhance the validity and power of the study, a total of 163 children who fulfilled the eligibility criteria were ultimately included. Sampling was conducted using a non-probability, consecutive technique, whereby every eligible child presenting during the study period was enrolled until the target sample size was achieved.

Children between the ages of 6 months and 24 months, of either gender, presenting with a fever lasting three or more days or with an axillary temperature greater than 37.5°C at the time of presentation were included. Children with a clear alternative diagnosis (such as otitis media, pneumonia, or skin infections), those with known chronic comorbidities such as congenital heart disease, chronic liver disease, or chronic kidney disease, and children admitted for planned procedures, trauma, or injury were excluded from the study to avoid confounding.

Following informed consent, a detailed history was obtained from each child's caregiver, and a thorough clinical examination was performed. Information regarding age, gender, weight, duration of fever, and

prior antibiotic use within the past seven days was documented on a structured proforma. Each enrolled child underwent venous blood sampling; 5 ml of blood was collected aseptically and submitted for blood culture using the BACTEC method to detect Salmonella species.

Data entry and statistical analysis were performed using IBM SPSS version 22.0. Continuous variables such as age and weight were expressed as mean ± standard deviation (SD). Categorical variables including gender, nutritional status, fever duration, prior antibiotic use, and blood culture results were reported as frequencies and percentages. Stratification was conducted for age, gender, weight, fever duration, and recent antibiotic use to control for effect modification. Post-stratification, the Chi-square test or Fisher's Exact test was applied, where appropriate, and a p-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 163 pediatric patients presenting with acute febrile illness were included in this study. The mean age of the participants was 13.23 ± 5.05 months, with the majority (67.5%) aged between 6–15 months, indicating a higher susceptibility to febrile illnesses in the younger infantile group. A relatively smaller proportion (32.5%) were aged 16–24 months.

Gender distribution revealed a slight male predominance, with boys comprising 58.3% (n=95) of the cohort, while girls accounted for 41.7% (n=68). This male-to-female ratio is consistent with previously reported trends in pediatric infectious disease epidemiology, potentially reflecting gender-related health-seeking behaviours or biological vulnerability.

The mean body weight was 9.07 ± 1.66 kg, with 65.0% (n=106) of children falling within the normal weight range for their age. However, a substantial 35.0% (n=57) were categorized as underweight, suggesting a significant burden of malnutrition among febrile children, which may influence immune function and clinical outcomes.

The average duration of fever prior to presentation was 5.02 ± 1.00 days. Notably, 72.4% (n=118) of children had fever lasting ≥5 days, indicating a delayed presentation to healthcare facilities. Only 27.6% (n=45) sought care within 5 days of symptom onset, underscoring potential barriers to early healthcare access or caregiver perception of illness severity.

Regarding recent antimicrobial exposure, 46.0% (n=75) of children had received antibiotics within the preceding 7 days, while 54.0% (n=88) had not. This relatively high rate of recent antibiotic use raises concerns about empirical antibiotic administration and highlights the need for judicious antibiotic stewardship, particularly in pediatric populations where viral aetiologies of fever are common.

Table 1. Demographic Characteristics of Children with Acute Febrile Fever (n=163)

Characteristics	**Participants**
Age (months)	13.23±5.05
6-15 months	110 (67.5%)
16-24 months	53 (32.5%)
Gender	
Boy	95 (58.3%)
Girl	68 (41.7%)
Weight (kg)	9.07±1.66
Normal Weight	106 (65.0%)
Underweight	57 (35.0%)
Duration of Fever (days)	5.02±1.00
<5days	45 (27.6%)
≥ 5 days	118 (72.4%)
Antibiotics used during Last 7-days	
Yes	75 (46.0%)
No	88 (54.0%)

As shown in table 2, among the 163 pediatric patients presenting with acute febrile illness, enteric fever was confirmed in 38 children (23.3%), while 125 children (76.7%) tested negative. This indicates that nearly one in four cases of febrile illness in this cohort was attributable to enteric fever, highlighting its continued public health significance in pediatric populations.

The relatively high prevalence of enteric fever among children under two years of age underscores the vulnerability of this age group to food- and waterborne infections, possibly due to immature immune systems and exposure to contaminated environments. These findings are consistent with epidemiological patterns observed in low- and middle-income countries, where poor sanitation and limited access to clean water contribute significantly to the burden of enteric infections.

From a clinical management perspective, the detection rate of 23.3% suggests that enteric fever remains a key differential diagnosis in pediatric febrile illnesses in endemic regions. This also emphasizes the importance of early diagnostic testing, appropriate antimicrobial therapy, and preventive strategies such as vaccination, improved hygiene practices, and public health education.

Furthermore, in light of the 46% recent antibiotic use reported in this cohort, the findings also raise concerns about potential empirical overtreatment and the emergence of antimicrobial resistance. This reinforces the need for robust diagnostic tools to accurately differentiate bacterial from viral causes of fever in young children.

Table 2. Frequency of Enteric Fever in Children with Acute Febrile Illness

Enteric Fever	Frequency (n)	Percent (%)
Yes	38	23.3 %
No	125	76.7 %
Total	163	100.0 %

Table 3 shows that the 163 children presenting with acute febrile illness, the frequency of enteric fever was further analysed across various demographic and clinical subgroups. The results revealed no statistically significant associations between enteric fever and any of the variables examined, as all p-values exceeded the conventional threshold of 0.05. Specifically, enteric fever was diagnosed in 21.8% of children aged 6–15 months and 26.4% of those aged 16–24 months (p = 0.516), suggesting that age within this range did not significantly influence the likelihood of infection. Similarly, a comparison by gender showed that 25.3% of boys and 20.6% of girls were affected (p = 0.486), indicating no significant gender-based difference in disease prevalence.

Nutritional status also did not show a meaningful association, with 21.7% of children with normal weight and 26.3% of underweight children testing positive for enteric fever (p = 0.506). Although underweight children showed a slightly higher frequency, the difference was not statistically significant, implying that malnutrition may not independently predict the presence of enteric fever. With respect to fever duration, 20.0% of children with fever lasting less than five days and 24.6% of those with fever for five days or more had enteric fever (p = 0.537), indicating that the length of fever was not a distinguishing factor for diagnosis in this cohort.

Lastly, recent antibiotic use within the past seven days was not associated with a significant difference in enteric fever prevalence, with 25.3% of children who had received antibiotics testing positive compared to 21.6% of those who had not (p = 0.573). Overall, these findings suggest that the occurrence of enteric fever in children with acute febrile illness was not significantly influenced by age, gender, nutritional status, duration of fever, or recent antibiotic exposure. This highlights the importance of laboratory confirmation rather than relying on demographic or clinical predictors alone when evaluating pediatric patients for enteric fever.

Table 3. Frequency of Enteric Fever in Children with Acute Febrile Illness Stratified for Various Subgroups

Subgroups	n	Enteric Fever n (%)	P-value
Age (months)			
6-15 months	110	24 (21.8%)	0.516
16-24 months	53	14 (26.4%)	
Gender			
Boy	95	24 (25.3%)	0.486
Girl	68	14 (20.6%)	
Weight (kg)			0.506

Normal Weight	106	23 (21.7%)	
Underweight	57	15 (26.3%)	
Duration of Fever (days)			
< 5days	45	9 (20.0%)	0.537
≥ 5 days	118	29 (24.6%)	
Antibiotics used during Last 7-days			
Yes	75	19 (25.3%)	0.573
No	88	19 (21.6%)	

Chi-square test/Fisher's Exact Test, observed difference was statistically insignificant with p-value>0.05.

DISCUSSION

In this study, the prevalence of enteric fever among children under two years of age presenting with acute febrile illness was found to be 23.3%, indicating that nearly one in four febrile cases in this age group may be attributed to enteric fever. Stratified analysis revealed no statistically significant associations between the presence of enteric fever and various demographic or clinical variables, including age group, gender, nutritional status, duration of fever, and recent antibiotic use. These findings suggest that enteric fever in young children presents with non-specific clinical features, making it difficult to distinguish from other causes of fever based on clinical presentation alone.

The observed prevalence of enteric fever (23.3%) in this study highlights a significant burden of disease among children under two years of age presenting with acute febrile illness. This figure aligns with the broader epidemiological understanding that enteric fever remains a common cause of prolonged fever in pediatric populations in low- and middle-income countries (S. Saha et al., 2020). However, the prevalence reported in our study is moderately higher than figures from some regional studies that have focused on older children or broader age groups, where rates have ranged from 10% to 20% (Das et al., 2022). The higher prevalence in our cohort may reflect the vulnerability of younger children, as well as contextual factors such as sanitation, hygiene practices, and access to clean drinking water.

In comparison to other studies from Pakistan, our findings are consistent with the high prevalence of enteric fever reported in urban and peri-urban settings. For instance, research conducted in Karachi and Lahore has reported substantial enteric fever burdens among children under five years of age (Yousafzai et al., 2020), though relatively few studies have focused specifically on the under-two age group. Similarly, studies from India (Saigal et al., 2021) and Bangladesh (Zabeen et al., 2022)—two other high-burden countries in South Asia—have reported comparable prevalence levels in young children, particularly in areas with inadequate water and sanitation infrastructure. Our findings support these regional trends and emphasize the persistent challenge of enteric fever in early childhood despite the availability of preventive strategies such as the typhoid conjugate vaccine (TCV).

Globally, enteric fever incidence is known to vary by age, with children aged 2–15 years historically considered the most affected group (Sinha et al., 2021). However, emerging data indicate that infants and toddlers are increasingly at risk, especially in endemic areas where early exposure to contaminated food and water is common (Piovani, Figlioli, Nikolopoulos, & Bonovas, 2024). Our findings contribute to this evolving understanding by demonstrating that a considerable proportion of febrile illnesses in children under two years of age may be attributable to enteric fever, reinforcing the need for early preventive interventions, improved surveillance, and targeted vaccination efforts in this vulnerable age group.

The finding that nearly one in four febrile children under the age of two was diagnosed with enteric fever is not only consistent with regional disease patterns but also clinically significant. Given the non-specific presentation of enteric fever in this age group and the absence of statistically significant associations with demographic or clinical predictors, the risk of misdiagnosis or delayed treatment is considerable (Parry, Basnyat, & Crump, 2013), particularly in settings where laboratory diagnostic facilities are limited or unavailable (Waddington, Darton, & Pollard, 2014). In such contexts, reliance on clinical judgment alone may lead to under-treatment or inappropriate antibiotic use, potentially exacerbating patient outcomes.

This underscores the urgent need for strengthened diagnostic infrastructure and broader implementation of preventive strategies, particularly in high-burden, resource-constrained environments (Shah, 2021). Our findings support the continued expansion and prioritization of such programs, given the early age at which children in endemic areas appear to be at risk. Furthermore, the observation that 46% of children had received antibiotics within the past seven days raises concern about the empirical overuse of antimicrobials (Karthikeyan et al., 2021; Md. Atiqul, Sheuly, Mohammad Mostafizur,

Md.Mizanur, & Bhuiyan, 2024), especially when enteric fever may not be laboratory-confirmed. This practice not only complicates clinical management but also contributes to the growing threat of antimicrobial resistance (AMR), which is particularly concerning in the treatment of multidrug-resistant Salmonella enterica serovars (Sharma, Vinayak, Aggarwal, Srivastava, & Aggarwal, 2020). These findings reinforce the need for more judicious use of antibiotics, guided by accurate diagnosis, surveillance data, and adherence to antimicrobial stewardship principles in pediatric care.

In addition to the broad clinical implications, the slightly higher prevalence of enteric fever observed among underweight children and those with fever lasting five days or more, although not statistically significant, may still carry clinical relevance. Malnourished children often have compromised immune responses, potentially increasing their susceptibility to infections such as enteric fever (Mondal et al., 2012). Similarly, prolonged fever duration may reflect a delayed immune response or failure of early empirical therapy. While our findings did not reach statistical significance, these trends suggest possible associations that merit further exploration. A larger sample size may help clarify whether nutritional status and fever duration are indeed independent risk factors for enteric fever in young children.

Limitations and Future Recommendations

Despite the valuable insights provided, this study has several limitations that should be acknowledged. Being a single-centre study, the findings may not be generalizable to broader populations across different geographic or socio-economic settings. The study also focused exclusively on children aged 6 to 24 months, limiting its applicability to older pediatric age groups. Additionally, data on recent antibiotic use relied on parental recall, which may introduce bias or inaccuracies. Furthermore, the cross-sectional design of the study precludes any conclusions about causal relationships between clinical variables and the presence of enteric fever.

Given these limitations, future research should aim to include larger, multicentre cohorts that represent diverse populations and environmental exposures. Expanding the age range would allow for a more comprehensive assessment of age-specific risks and disease patterns. Prospective cohort studies would be particularly useful in exploring causal links between risk factors and enteric fever incidence. Moreover, there is a need to develop and validate clinical scoring systems or diagnostic algorithms tailored for low-resource settings, which can support early identification and treatment of enteric fever in the absence of laboratory confirmation. Such efforts could significantly enhance diagnostic accuracy, reduce inappropriate antibiotic use, and improve overall outcomes in pediatric febrile illness.

CONCLUSION:

Enteric fever was identified in nearly one-fourth of febrile children under two years of age, highlighting its clinical relevance in this age group. Although no statistically significant associations were found with demographic or clinical variables, the findings underscore the need for heightened diagnostic vigilance, improved laboratory access, and strengthened preventive strategies, including targeted vaccination efforts in endemic settings.

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Data sharing statement: The datasets used and/or analysed during the current study is available from the corresponding author on reasonable request and will be provided according to the policy of University of Child Health Sciences, The Children Hospital, Lahore where the study has been conducted.

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