



ORIGINAL ARTICLE

## Frequency of microorganisms in children presenting with acute fever at the outpatient department.

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**ABSTRACT... Objective:** To determine the incidence of blood stream bacterial infection and the frequency of microorganisms involved as evaluated by blood culture in children presenting with acute febrile illness at the outpatient department. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatrics and Child Health, Mardan Medical Complex, Mardan, Pakistan. **Period:** 1<sup>st</sup> March 2023 to 31<sup>st</sup> of August 2023. **Material & Methods:** A total of 252 children from both genders between the ages of 1 month to 15 years presented at outpatients department with fever ( $\geq 38.0^{\circ}\text{C}$  or  $100.4^{\circ}\text{F}$ ) for > two days were included in the study using consecutive sampling technique. The blood cultures of these children were sent to the laboratory for investigations. Bacterial strains were isolated and identified using standard microbiological techniques. The primary outcome was to determine the incidence of blood stream bacterial infection and the frequency of microorganisms involved. **Results:** The Mean $\pm$ SD of age in this study was  $4.20\pm 3.42$  years with an age range of 0.5-14 years. Male gender was 51.59% while female gender was 48.41%. The results of blood culture report showed that bacterial growth was present in 37 (14.68%) of total study patients. Out of these positive blood cultures, Gram-positive Cocci was reported in 16 (43.24%) of the children while Gram-negative bacilli were present in 21 (56.76%). The prevalence of E Coli was highest in these children 10 (27.02%) followed by S Typhi 8 (21.62%), Streptococcus pneumonia 5 (13.51%) and S aureus 4 (10.81%). **Conclusion:** It was concluded that the Gram-negative bacilli are the common cause of bacterial infection in children presenting with fever at outpatient department of a tertiary care hospital in this region with most frequent presence of E Coli and S Typhi.

**Key words:** Acute Fever, Bacterial Infection, Blood Culture, Children, Microorganisms.

### INTRODUCTION

Polymicrobial infections with viruses, bacteria and malaria are common in children and may be clinically indistinguishable especially in low-resource settings.<sup>1</sup> In low and middle income countries, about 80% of children reporting at hospitals and clinics have acute fever and it is mentioned as leading cause of morbidity and mortality in children around the world.<sup>2,3</sup>

Different definitions of subjective and objective fever have been used for diagnosis of acute febrile illness (AFI), with varying temperature thresholds, duration of fever and need for accompanying clinical markers.<sup>4</sup> A common cause of acute fever is mosquito bite which becomes a dominant reason of fever after monsoon season, it is,

however easily differentiated through signs and symptoms and laboratory investigations.<sup>5</sup> Besides malaria and viral infections being the most common causes of this acute fever in children, there are dozens of other bacterial, fungal and parasitic causes.<sup>6</sup> Unfortunately, the available white blood cell markers are not able to distinguish between malarial infections, viral infections, and bacterial infections.<sup>7</sup> As a result, a broad spectrum of tests must be used to make an accurate diagnosis but due to time and cost limitations, most of the focus is given on a small number of suspect pathogens.<sup>8</sup>

The bacterial infection refers to the presence of pathogenic bacteria in the blood stream and the onset of infection is confirmed by signs and

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symptoms of infection followed by blood culture.

Bacterial infection in the bloodstream can cause sepsis, a condition in which the body's immune system fails to fight off infection, leading to organ dysfunction that can be life-threatening. It has been reported that bacterial infection is linked to 25-30% cases of sepsis.<sup>9</sup> The global estimation of incidence of mortality in children is as high as 10 million/year and sepsis is responsible for approximately 60-80% of these death incidences.<sup>10</sup>

One of the biggest threats that modern medicine faces is antimicrobial resistance. In the United States alone, over 35,000 people have died as a result of antibiotic resistance.<sup>11</sup> The data shows variety of patterns of bacterial infections in different areas that's why it's important to understand the local pathogen epidemiology so that the early intervention can be introduced to cure the infection.<sup>12</sup> Clinicians must be cognizant of the frequency of microorganisms involved in AFI in children of their region in order to effectively modify their prescribing practices to prevent the development of antimicrobial resistance and to prevent the overuse of last resort antibiotics.<sup>13</sup>

The aim of the study was therefore to determine the incidence of blood stream bacterial infection and frequency of microorganisms involved in clinically diagnosed children with acute fever. The results of this study will contribute to the development of standard guidelines for empirical treatment in children with bacterial fever in our region and will help to avoid the misuse and overuse of antibiotics.

## MATERIAL & METHODS

This cross-sectional study was conducted at the Department of Pediatrics and Child Health, Mardan Medical Complex, Mardan, Pakistan over a period of 6 months from 1st March 2023 to 31st of August 2023.

Sample size was calculated as  $n=252$ , with expected prevalence of *Enterococcus* species =6.3%, Margin of error=3 % and 95% Confidence level using WHO sample size software.<sup>14</sup>

A total of 252 children from both genders between the ages of 1 month to 15 years presented at outpatients department with fever ( $> 38.0^{\circ}\text{C}$  or  $100.4^{\circ}\text{F}$ ) for  $\geq 2$  days were included in this study using non-probability consecutive sampling technique. Exclusion criteria were the children who had consulted with these complaints and had been given antibiotics within last one week and children planned for hospital admissions (cases of injury/trauma/elective surgery).

The demographic data and clinical history of children was taken and recorded on given format. The blood culture of these children was taken and sent to the laboratory of the hospital for investigations. Bacterial strains were isolated and identified using standard microbiological techniques. The primary outcome was to determine the incidence of blood stream bacterial infection and the frequency of microorganisms as evaluated by blood culture.

Ethical approval of conducting the study was taken from the ethical committee of the hospital (354/BKMC).

The study purpose was explained and consent was taken from the parents/guardians on written forms.

Data analysis was performed using SPSS version 25. Quantitative variables like age, weight, temperature and duration of fever were expressed in form of Mean $\pm$ SD. Qualitative variables like gender and identified bacterial strains were expressed in form of frequency and percentage. Descriptive analysis was done by applying frequency and percentage.

## RESULTS

The Mean $\pm$ SD of age in this study was  $4.20\pm 3.42$  years with an age range of 0.5-14 years. Male gender was 51.59% while female gender was 48.41%. The details of demographics and clinical findings are given in Table-I.

In blood samples where the results of blood cultures was positive, presence of Gram-positive cocci (GPC) was reported in 16 (43.24%) of the

children while Gram-negative bacilli (GNB) were present in 21 (56.76%) of the children. Details of microorganisms reported in blood culture are shown in Table-II.

Demographics and Clinical Findings		
Age (Years) Mean±SD		4.20±3.42
Gender	Male n (%)	130 (51.59)
	Females n (%)	122 (48.41)
Body weight (Kg) Mean±SD		12.29±6.41
Duration of fever (Days) Mean±SD		4.17±1.21
Body Temperature (°F)		38.79±0.80
Blood Culture Findings	Bacterial Growth n (%)	37 (14.68)
	No Bacterial Growth n (%)	215 (85.32)

**Table-I. Demographics and clinical finding of children. n=252**

Microorganisms Detected	
GNB n (%)	21 (56.76)
Escherichia-coli n (%)	10 (27.02)
Salmonella typhi n (%)	8 (21.62)
Pseudomonas aeruginosa n (%)	2 (5.40)
Klebsiella n (%)	1 (2.70)
GPC n (%)	16 (43.24)
Streptococcus pneumonia n (%)	5 (13.51)
Staphylococcus aureus n (%)	4 (10.81)
Enterococcus faecalis n (%)	3 (8.10)
CoNS* n (%)	2 (5.40)
Bacillus n (%)	2 (5.40)

**Table-II. Details of microorganisms detected in children reported with bacterial infection. n=37**

**\* Coagulase-negative staphylococcus**

The most common clinical signs and symptoms in children presenting with fever and having bacterial infections were headache (86.84%) followed by abdominal pain (75.67%). The primary diagnosis suggested for these children were GI Infections (32.43%) and UTI (24.32%) as shown in Table-III.

Clinical Signs and Symptoms	
Headache n (%)	32 (86.48)
Abdominal Pain n (%)	28 (75.67)
Diarrhea n (%)	16 (43.24)
Vomiting n (%)	15 (4.54)
Cough n (%)	8 (21.62)
Sore throat n (%)	5 (13.51)
Skin Rash n (%)	3 (8.1)
Primary Diagnosis	
GI Infections n (%)	12 (32.43)
UTI n (%)	9 (24.32)
RTI n (%)	8 (21.62)
Enteric Fever n (%)	5 (13.51)
Pneumonia n (%)	3 (8.1)

**Table-III. Details of clinical signs and symptoms and primary diagnosis in children reported with bacterial infection. n=37**

## DISCUSSION

Acute febrile illness in children is commonly presented in pediatric outpatient departments and can be treated effectively if the etiology is found and treatment is recommended as per the causative agents involved.

Tariq TM and Rasool E conducted a study in a tertiary care hospital in Kabul to determine the frequency of pathogens causing bloodstream infections. The results of the study show that GNB were the most common cause of blood stream infections (50.77%) followed by GPC (45.58%). Among GNB 35.86% belonged to the Enterobacteriaceae including 16.15% Klebsiella (6.25% were E coli) while 14.9% were non-fermenters including 8.46% Pseudomonas aeruginosa. The overall conclusion by the researchers was that Klebsiella and Staphylococci were the most frequently found bacteria causing blood stream infections as reported in a tertiary care hospital. An increase in the frequency of Pseudomonas and B was also reported in the study.<sup>15</sup>

Soomro T conducted a study in Pakistani population to find the frequency and etiology of community acquired blood stream bacterial infection in children who were hospitalized due to fever. The results of blood culture showed the prevalence of bacterial infection by 8.4% where Salmonella typhi was most prevalent followed by E coli.<sup>16</sup>

Ogunkunle TO planned a cohort study to predict bacteremia in children under 5 years of age with acute undifferentiated fever reported at a secondary health care facility. Out of these children, 78% were presented and managed at the out-patient department. The prevalence of bacteremia was reported to be 17% while the most prevalent among these was Salmonella Typhi (40.1% of total isolated pathogens).<sup>17</sup>

Muhammad A and co-workers conducted a cross-sectional study in Peshawar Pakistan to determine the prevalence of blood stream infections and frequency of microorganisms involved in these infections in children reporting

with fever at pediatric ward. The study reported prevalence of this infection in 19.6% of the children. The predominant microorganism class was gram-negative bacteria (71.1%) followed by gram-positive bacteria (28.9%). The most commonly reported bacteria isolate were *S Typhi* (31.5%), *E coli* (17.1%), *S aureus* (16.2%), *K pneumonia* (10.8%) and *Enterococcus* (6.3%). The researchers thereby concluded that gram negative bacteria were the most prominent bacteria in this type of infections.<sup>14</sup>

A recently published 10 year study in pediatric patients to find the epidemiology of bacteremia found positive blood cultures in 6.6% of the samples. Among the patients with bacteremia the prevalence of streptococcus pneumonia was highest (29.2%) while the staphylococcus aureus was second most prevalent (19.2%). The study reported that among children below the age of 3 months, *e coli* were most prevalent. The study concluded that microbiological monitoring in children has useful implications, especially when it comes to local antibiotic prescriptions.<sup>18</sup>

The Mean±SD of age in our study was 4.20±3.42 years with an age range of 0.5-14 years. Male gender was 51.59% while female gender was 48.41%. The mean duration of fever was 4.17±1.21 days while the mean body temperature was 38.79±0.80 °F.

The results of blood culture report showed the bacterial growth in 37 (14.68) of total study patients. These results are in line with the studies discussed above over the topic.<sup>14,17</sup>

GPC was reported in 16 (43.24%) of the children while GNB were present in 21 (56.76%) of the children. The prevalence of *E Coli* was highest in these children 10 (27.02%) followed by *Salmonella Typhi* 8 (21.62%), *Streptococcus pneumonia* 5 (13.51%) and *Staphylococcus aureus* 4 (10.81%). Other microorganism reported were *Enterococcus faecalis* 3 (8.1%), *Pseudomonas aeruginosa* 2 (5.4%), *CoNS* 2 (5.4%), *Bacillus* 2 (5.4%) and *Klebsiella* 1 (2.7%). These findings are also in line with findings reported in previous studies particularly those conducted in low and middle

income countries and communities.<sup>14,15,16,17,18</sup>

Hence accurate diagnosis of pathogens or determining the other underlying causes of acute fever is a key step and most acute fevers can be accurately diagnosed based on good history, adequate physical examination and laboratory investigations.<sup>19</sup> A major limitation of this study is that it was conducted mostly during the summer season hence a particular type of microorganisms may be more prevalent in this season. More studies conducted in other seasons of the year may be helpful in adding up more data in the subjects.

## CONCLUSION

Using the right protocol for diagnosis of acute fever and opting for blood culture help in the proper use of antibiotics and helps in reducing antibiotic costs and resistance. The findings of this study shows that the Gram-negative bacilli are the common cause of bacterial infection in children presenting with fever at outpatient department of a tertiary care hospital in this region with most frequent presence of *E Coli* and *Salmonella Typhi*.






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### AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Shahana Nisar	Data interpretation, Manuscript writing, Critical review.	
3	Nighat Musa	Collection of references, Revision of Manuscript.	
4	Syed Mohsin Ali Shah	Collection of references, Critical review.	
5	Hameed Ul Haq	Critical review, Final checking of manuscript.	
6	M. Shahan Jan	Collection of data revision of manuscript.	