

## Importance of Diarrheogenic *Escherichia coli* (DEC) strains isolated from pediatric patients in a Tertiary care Hospital

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### Abstract

**Introduction:** Diarrheal disease is a major cause of illness and death among infants and young children worldwide. Among the *Escherichia coli* (*E. coli*) causing intestinal diseases, there are six well-described categories Enteroaggregative *E. coli* (EAEC), Diffusely Adherent *E. coli* (DAEC), Enteroinvasive *E. coli* (EIEC), Enteropathogenic *E. coli* (EPEC), Enterohaemorrhagic *E. coli* (EHEC) and Enterotoxigenic *E. coli* (ETEC).

**Aim:** To investigate contribution of different groups of Diarrheogenic *E. coli* (DEC) in pediatric patients with diarrhea.

**Materials and Method:** This was Prospective laboratory based study approved by Institutional Ethical committee. A total of 100 stool samples were collected from patients admitted with acute diarrhea of 72 hours or less duration in 1- 60 months of age over a period of one year (Sep 2012 to Aug 2013). *Escherichia coli* were identified by standard Microbiological methods and identified *E. coli* were transported to National Institute of Salmonella and *Escherichia coli* center for further Serotyping.

**Results:** The majority of children with diarrhea were in the age group of 7 to 12 months of age (46%). Watery diarrhea was present in 94% of children, followed by vomiting and fever (78%). The study showed that 48 100 children (48%) had diarrhea due to diarrheogenic *E. coli*. The most prevalent type was ETEC (20.8%) followed by EPEC (16.7%), EHEC (4.1%), and STEC (2.1%). The most prevalent serotypes of ETEC were O27, O23, O169. Among EPEC most prevalent serotypes were O90, O26. The most prevalent EHEC strain found in this study was O71.

**Conclusion:** Study shows that diarrheogenic *E. coli* is a significant causal agent of diarrheal diseases in pediatric patients and it is a preventable by mere increase in hygiene, education, drinking safe water.

**Keyword:** Enteroaggregative *E. coli* (EAEC), Diffusely Adherent *E. coli* (DAEC), Enteroinvasive *E. coli* (EIEC), Enteropathogenic *E. coli* (EPEC), Enterohaemorrhagic *E. coli* (EHEC) and Enterotoxigenic *E. coli* (ETEC).

### Introduction

Acute diarrhea is important public health problems worldwide. It accounts for morbidity and mortality in all age groups with 3<sup>rd</sup> and the 6<sup>th</sup> causes of morbidity and mortality respectively, especially among infant and children leading to 2-2.5 million deaths and billion episodes annually.<sup>(1,2)</sup> As per WHO report, around 11 million children < 5 years of age die because of *E. coli* mediated diarrhea.<sup>(3)</sup> The most predominant bacterial infections that cause diarrhea are *Salmonella spp*, *Shigellaspp*, *Campylobacter jejuni*, *Yersinia enterocolitica*, and *Diarrheogenic Escherichia coli* (DEC). DEC is considered as important cause of diarrhea in children.<sup>(4)</sup>

There different groups of *diarrheogenic E. coli* (DEC) including *Enteropathogenic E. coli* (EPEC), *Enteroinvasive E. coli* (EIEC), *Enterotoxigenic E. coli* (ETEC), *Enteroaggregative E. coli* (EAggEC), *Diffuse-adhering E. coli* (DAEC) and *Verotoxin-producing E. coli* (VTEC) or *Shiga-toxin producing E. coli* (STEC) (includes *Enterohaemorrhagic E. coli* (EHEC)). The incidence of DEC is unknown in India as very few laboratories report these organisms. ETEC and EPEC are important and major bacterial pathogens causing diarrhea in India.

Children in developing countries have more frequent diarrheal episodes in first year of life.

Repeated and persistent diarrhea in children leads to growth impairment having impact on child's development.<sup>(5-7)</sup> Diarrhea contributes to malnutrition and growth impairment and *Escherichia coli* diarrheas are more contributing than other infections.<sup>(5,8,9)</sup> Thus this study was planned to investigate distribution of *Diarrheogenic E. coli* (DEC) in pediatric patients with diarrheal illness.

### Materials and Method

**Sample size:** 100 stool samples were collected from pediatric patients (1 to 60 months of age) admitted in a tertiary care hospital.

The study was approved by Institutional Ethical committee and was a prospective laboratory based study conducted over a period of one year (September 2012 to August 2013).

**Inclusion criteria:** Patients with acute diarrhea of 72 hours or less duration in 1- 60 months of age.

**Exclusion criteria:**

- Child currently on antibiotics or anti parasitic drugs or 10 days prior received antibiotics or anti parasitic drugs
- Child having associated illness such as pneumonia, measles or malaria.

**Collection of Sample:** Fresh stool samples were collected in a sterile and dry wide mouthed containers. Samples were immediately processed in the laboratory.

Upon arrival the samples were inoculated into MacConkey (MA) and incubated overnight at 37°C. *E.coli* was identified based on colony morphology and biochemical tests. (Standard Microbiological methods)

For serotype confirmation of *Escherichia coli* strains were sent to National *Salmonella* and *Escherichia coli* Research Center, Kasauli.

## Results

The present study included 100 pediatric patients, <5 years of age with acute gastroenteritis admitted to Tertiary care hospital during Sep 2012 to Aug 2013.

The majority of children with diarrhea were in the age group of 7 to 12 months of age (46%). In the present study percentage of male (56%) was greater than female (44%).

Watery diarrhea was present in 94% of children, followed by vomiting and fever (78%).

*Escherichia coli* (48%) was the most commonly isolated bacterial pathogen. *ETEC* (20.8%) was most common type followed by *EPEC* (16.7%), *EHEC* (%), and *STEC* (2.1%).

The most prevalent serotypes of *ETEC* were O27, O23, O169. Among *EPEC* most prevalent serotypes were O90, O26. The most prevalent *EHEC* strain found in this study was O71.

## Discussion

Acute diarrheal diseases remain to be an important cause of morbidity and mortality in children <5 years of age, particularly in developing countries. In India, diarrheal disease is a main public health problem among children <5 years of age and one third of total pediatric hospital admissions are due to diarrheal diseases and 17% of all deaths in admitted pediatric patients are diarrhea related.<sup>(10)</sup> There are very few studies regarding *DEC* this study aimed at investigating distribution of different groups of *Diarrheogenic E. coli* (*DEC*) in pediatric patients with diarrhea.

In the present study, pathogenic bacteria were isolated in 51% of children, *Escherichia coli* was most common (48%), followed by *Shigella flexneri* (2%) and *Vibrio cholera* (1%) of children. *Escherichia coli* were serotyped at National *Salmonella* and *Escherichia coli* Center, Kasauli and *ETEC* (20.8%) was most common type followed by *EPEC* (16.7%), *EHEC* (4.1%), and *STEC* (2.1%).

A big review included different descriptive studies were done in low and middle countries in five hospitals in China, India, Mexico, Myanmar and Pakistan among children aged 0-35 months. A total of 3640 children with acute diarrhea and 3279 age- and sex matched controls showed that the most strongly pathogens associated with diarrhea were *ETEC* (16% of cases and 5% of control), rotavirus (16% of cases and 2% of

control) and *shigella* spp (11% of cases and 1% of control).<sup>(11)</sup>

More work is still needed to determine the prevalence of *DEC* among children. In addition education of mothers and children about hand-hygiene is important along with other safe methods such as drink pasteurized beverages, eat cooked meat avoid direct contact with animals and wash hands after handling raw meat.

## Summary and Conclusion

Study shows that *Diarrheogenic E. coli* is a significant causal agent of diarrheal diseases in pediatric patients and it is preventable by mere increase in hygiene, education, drinking safe water and practicing safe methods.

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