

## CLINICAL NOTE

# DIARRHEA CAUSED BY ENTEROPATHOGENIC BACTERIA IN CHILDREN

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### Abstract

**Background**-Diarrhea is a major cause of mortality in 15 to 20 percent of the under 5-year-olds, and among the bacterial agents causing diarrhea, the five most important are *Shigella*, *Salmonella*, *E. coli*, *Campylobacter* and *Yersinia*.

**Methods**-In a one-year study conducted in cooperation with a local health center in Islamshahr, South of Tehran, rectal swabs were collected from children less than 5 years of age who presented with diarrhea. Frequency evaluations of *Yersinia* and *Campylobacter* along with other intestinal bacterial pathogens were made.

**Results**-A total of 1600 samples were analyzed, 235 (14.7%) of which were positive. Most (119 cases; 50%) high-risk ages included children less than 2 years of age. Enteropathogenic *Escherichia coli* (EPEC) was the most common (109 cases; 6.8%) cause of diarrhea followed by *Shigella* (54 cases; 3.4%), *Salmonella* (46 cases; 2.9%), *Campylobacter* (15 cases; 0.9%) and *Yersinia* (11 cases; 0.7%). Seasonal investigations show that, with the exception of *Yersinia*, all pathogenic bacteria are the most frequently isolated organisms occurring in the summer.

**Conclusion**-Better knowledge about the causes of infection and the epidemiological situation could help the management of intestinal infections.

**Keywords** • Diarrhea • bacterial • children • gastroenteritis

### Introduction

Diarrhea is a major cause of mortality in 15 to 20 percent of the under 5-year-old children<sup>1</sup> and it contributes to approximately 5 to 10 million cases of mortality in Asia, Africa and Latin America. Diarrhea is caused by a variety of infectious agents. Among the bacterial agents, the five most important are *Shigella*, *Salmonella*, *Escherichia coli*, *Yersinia*, and *Campylobacter*.

This study was conducted in cooperation with the local health center of Islamshahr (allied to Tehran University of Medical Sciences), South of Tehran, with the aim of obtaining etiological, epidemiological and demographic data on children with acute bacterial diarrhea.

### Materials and Methods

During a one-year period (June 1998 to June 1999), a total of 1600 rectal swabs were collected from children less than 5 years of age presenting with acute diarrhea. Acute diarrhea was defined as illness less than 2 weeks duration.

The specimens were inoculated in Cary-Blair transport medium and immediately sent to the Microbiology Laboratory of the Public Health Faculty, Tehran University of Medical Sciences. Each specimen was examined microscopically and then cultured according to the standard method adopted from the WHO on Endo agar, *Salmonella-Shigella* (SS) agar, CIN agar and *Campylobacter*-selective agar.<sup>2</sup> For isolation of *Salmonella*, the specimens were incubated in selenite F medium for 12 hours before primary culture. For isolation of *Yersinia*, the cold enrichment method was used in which the specimens were incubated at 4° C for 2 weeks, inoculated in selective medium

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## Bacterial Diarrhea in Children

**Table 1.** Enteropathogenic bacteria isolated from children with diarrhea in Islamshahr.

Pathogen	<i>E. coli</i>	<i>Shigella</i> spp	<i>Salmonella</i> spp	<i>Yersinia</i> spp	<i>Campylobacter</i> spp
Species/ subtypes, N (%)	EPEC: 109 (100)	<i>S. sonnei</i> : 42 (77.8) <i>S. flexneri</i> : 11 (20.4) <i>S. dysenteriae</i> : 1 (1.8)	<i>S. typhi</i> : 23 (50) <i>S. paratyphi B</i> : 20 (43.5) <i>S. paratyphi C</i> : 3 (6.5)	<i>Y. enterocolitica</i> : 9 (81.8) <i>Y. frederiksenii</i> : 1 (9.1) <i>Y. intermedia</i> : 1 (9.1)	<i>C. jejuni</i> : 13 (86.7) <i>C. coli</i> : 2 (13.3)
Total (n=1600)	109 (6.8)	54 (3.4)	46 (2.9)	11 (0.7)	15 (0.9)

(CIN agar) and finally incubated at 25° C for 48 hours. For isolation of *Campylobacter*, regarding its microaerophilic conditions of growth, Gaspack system and anaerobic jar were used. After inoculation, the plates were incubated at 4° C for 48 hours, and the suspected colonies were identified. For isolation of *Enteropathogenic E. coli* (EPEC) and *Shigella*, without a non-specific process, rectal swabs were inoculated on Endo agar and SS agar. The suspected colonies were identified by anti-serum manufactured by DifCo, USA.

### Results

From the 1600 rectal swabs analyzed, 235 (14.7%) revealed positive bacterial cultures. Table 1 shows the various enteropathogenic bacteria isolated from the specimens. Enteropathogenic *E. coli* was the most prevalent agent comprising 6.8% of all positive cultures. *Shigella* spp (3.4%) and *Salmonella* spp (2.9%) ranked second and third respectively.

The prevalence of various pathogens was different across age groups. *Campylobacter* spp were only met in children less than 2 years of age. While, two-thirds of EPEC (67%) and *Yersinia* (63.6%) and around one-third of *Shigella* (25.9%) and *Salmonella* (21.7%) infections occurred in children waged less than 2 years (Table 2).

Seasonal investigations showed that diarrhea due to EPEC, *Shigella*, *Salmonella*, and

*Campylobacter* mostly occurred in the summer whereas diarrhea caused by *Yersinia enterocolitica* was prevalent in the spring (Figure 1).

### Discussion

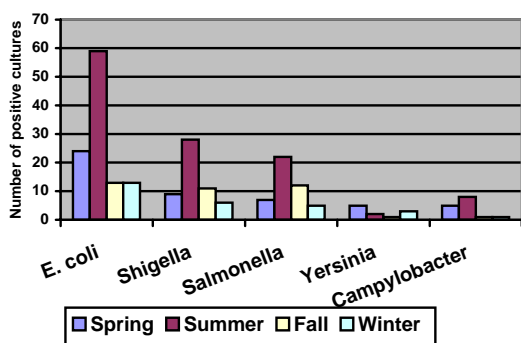
Acute diarrhea is an important health problem in children as well as adults.<sup>3</sup> This study showed that five bacterial agents i.e. *E. coli*, *Shigella*, *Salmonella*, *Campylobacter* and *Yersinia* play a major role in pediatric gastroenteritis in southern Tehran. The prevalence rate of bacterial diarrhea in our sample was 14.7%, whereas Naqvi in the USA<sup>7</sup> and Germani<sup>8</sup> in New Caledonia (tropical climate), reported a prevalence of 8.6% and 28% respectively.

The etiology of diarrhea varies according to geographic and climatic conditions. In contrast to the warm and tropical areas<sup>4,5</sup>, in cold regions including Europe, *Vibrio cholera*, *Aeromonas*, *Plesiomonas* and *Shigelloides* are seldom isolated. The prevalence of psychrophilic bacteria such as *Yersinia* in intestinal infections is higher in the colder than the warmer climates.<sup>6-8</sup>

The results of this study present a profile of various pathogens including *Campylobacter* and *Yersinia*, specifically the *Y. intermedia* and *Y. frederiksenii* among other intestinal pathogens in the region. Individuals and health services should be aware of this prevalence pattern and perform necessary medical interventions.

**Table 2.** Age distribution of 235 culture-positive children with gastrointestinal bacterial infections.

Age (year)	<i>E. coli</i> No (%)	<i>Shigella</i> spp No (%)	<i>Salmonella</i> spp No (%)	<i>Yersinia</i> spp No (%)	<i>Campylobacter</i> spp No (%)
0-1	30 (27.5)	4 (7.4)	4 (8.7)	3 (27.3)	11 (73.3)
1-2	43 (39.5)	10 (18.5)	6 (13)	4 (36.3)	4 (26.7)
2-3	20 (18.4)	10 (18.5)	8 (17.4)	2 (18.2)	0
3-4	14 (12.8)	18 (33.4)	10 (21.8)	0	0
4-5	2 (1.8)	12 (22.3)	18 (39.1)	2 (18.2)	0
Total	109 (100)	54 (100)	46 (100)	11 (100)	15 (100)



**Figure 1.** Isolation of gastrointestinal pathogens from children with diarrhea in different seasons.

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