Antimicrobial Resistance of Diarrheagenic Escherichia coli Isolated from Children under the Age of 5 Years from Ifakara, Tanzania

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Diarrhea caused by multidrug-resistant bacteria is an important public health problem among children in developing countries. The prevalence and antimicrobial susceptibility of diarrheagenic Escherichia coli in 346 children under 5 years of age in Ifakara, Tanzania, were studied. Thirty-eight percent of the cases of diarrhea were due to multidrug-resistant enterotoxigenic E. coli, enterohemorrhagic E. coli, enteropathogenic E. coli (EPEC), enteroinvasive E. coli, and enteraggregative E. coli (EAggEC). The most prevalent enterotoxins were heat-stable toxin (ST) and verotoxin (VT) production. In this study, 24-h McConkey agar cultures were used to detect E. coli isolates. E. coli ATCC 25922 (negative control) and E. coli ATCC 25921 (positive control) were included in each test. The strains were tested for their susceptibility to six antimicrobial agents by using the E-test method. Colonies from 24-h McConkey agar cultures were homogenized with 0.85 saline, and the turbidity was adjusted to that of a 0.5 McFarland standard. The inoculum suspension was spread on a Mueller-Hinton agar plate surface with a swab, and after that the plates had sat on the bench 15 min, E-test strips were applied. The inoculated medium was incubated for 20 h at 37°C, and the MICs were read. The National Committee for Clinical Laboratory Standards breakpoints were used to differentiate between susceptible and resistant isolates. DNA from each E. coli isolate was subjected to PCR under the conditions described in reference 9 to determine the correct diarrheagenic category. The MICs of six antimicrobial agents for the diarrheagenic E. coli isolates were determined by the E-test method. Colonies from 24-h McConkey agar cultures were homogenized in 0.85 saline, and the turbidity was adjusted to that of a 0.5 McFarland standard. The inoculum suspension was spread on a Mueller-Hinton agar plate surface with a swab, and after that the plates had sat on the bench 15 min, E-test strips were applied. The inoculated medium was incubated for 20 h at 37°C, and the MICs were read. The National Committee for Clinical Laboratory Standards breakpoints were used to differentiate between susceptible and resistant isolates (6). E. coli ATCC 25922 was used as a reference strain for quality control purposes. ETEC strains were isolated from 44 children (12.7%). The distribution of these strains according to the type of enterotoxin synthesized was as follows: 33 strains (75%) produced the heat-stable toxin (ST), 6 strains (14%) synthesized the heat-labile toxin (LT), and 5 strains (11%) produced both toxins. EAggEC strains were isolated from 82 (23%) children, and verotoxin-2-producing E. coli was detected in one child; no enteroaggregative E. coli strains were isolated. Seventeen of these 82 EAggEC strains also produced LT and/or ST. Of these 17 strains, 15 synthesized ST, one strain produced LT, and one strain synthesized both toxins. Finally, 21 EPEC strains were isolated in 21 cases (6%). In this study, three PCR methods were used to detect EPEC strains. Twenty-one strains were found to have at least one of these genes; of the 21 strains, 13 had the eaeA gene, 1 strain had only the bfp gene, and 5 strains were eae and bfp positive. One strain was positive for both eae and EAF, and 1 strain was positive for eae and bfp. Therefore, it seems that the presence of the eae gene is more highly linked to EPEC than the presence of either the bfp gene or EAF, as has been previously suggested (7).

In this study, ETEC was found to be the category of diarrheagenic E. coli which most frequently causes diarrhea in children under 5 years of age, as has been reported for many...
ETEC (44) Amp r Clr Tcr Sxtr Nalr Cips 1 (2.3)
EAggEC (65) Amp r Clr Tcr Sxtr Nalr Cips 1 (1.5)
EPEC (21) Amp s Cls Tcs Sxts Nals Cips 1 (4.7)

were 4
m
E. coli
in Table 1. For all three categories of diarrheagenic
different categories of diarrheagenic
E. coli
EAggEC, and EPEC strains being the most prevalent.

age are due to multiresistant diarrheagenic
(4). Overall, 38% of diarrhea cases in children under 5 years of

producing verotoxin-2, was isolated. This result is in agreement
diarrhea in children (5). In our study, only one EHEC strain,
shown the importance of EAggEC and EPEC as a cause of
studies in developing countries (4). Several studies have also
importance of EAggEC and EPEC as a cause of

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REFERENCES