

ESCHERICHIA COLI: A CAUSE FOR DIARRHEA

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ABSTRACT

Escherichia coli is one of the most frequent causes of many common bacterial infections, which include cholecystitis, bacteremia, Cholangitis, Urinary tract infection (UTI), traveler's diarrhea and other clinical infections such as neonatal meningitis and pneumonia. The genus Escherichia is named after Theodor Escherich, who isolated the species of the genus. Escherichia organism are gram-negative bacilli that exist singly or in Pairs. Escherichia coli is facultatively anaerobic with a type of metabolism that is both fermentative and respiratory. They are either non-motile or motile by peritrichous flagella. E. coli is a major facultative inhabitant of the large intestine. The aims of the research are to determine Diarrhea cause by Escherichia Coli, while some of the objectives the research try to achieve are, To determine the pathotypes that are associated with diarrhea, to identify the causes of E.coli infection and to provide preventive measures on E.coli infection

Key wards: Diarrhea, Escherichia Coli, Vomiting, Abdominal pain.

I. INTRODUCTION

Escherichia coli is one of the most frequent causes of many common bacterial infections, which include cholecystitis, bacteremia, Cholangitis, Urinary tract infection (UTI), traveler's diarrhea and other clinical infections such as neonatal meningitis and pneumonia.

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Escherichia coli (E. coli) bacteria normally live in the intestine of people and animals. most Escherichia coli are harmless and they are important part of a healthy human intestinal tract. However, some intestine is pathogenic, which means they can cause infection or illness, either diarrhea or illness outside the intestinal tract. the type of Escherichia coli that can cause diarrhea can be transmitted through contaminated water or food, or through contact with animal or persons. Escherichia coli consists of a diverse group of bacteria.

Diarrhea caused by E. coli

The strains that acquired bacteriophage or plasmid DNA encoding enterotoxins or invasion factors become virulent and can cause either a plain, watery diarrhea or an inflammatory dysentery. These diseases are most familiar to Westerners as traveller's Diarrhea, but they are also major health problems in endemic countries, Particularly among infants. Three groups of Escherichia coli are associated with diarrheal diseases. Escherichia coli strains that produce enterotoxins are called enterotoxin-genic Escherichia Coli (ETEC). there are numerous types of enterotoxin. Some of these toxins are cytotoxic which damage the mucosa cells, where as other are merely cytotoxic, inducing only the secretion of water and electrolyte. A second group of Escherichia coli

strains have invasion factors and cause tissue destruction and inflammation resembling the effect of shigella (EIEC). A third group of Serotypes, called enter pathogenic *Escherichia coli* (EPEC) are associated with outbreaks of diarrhea in newborn nurseries, but produce no recognizable toxins or invasion factors.

II. LITERATURE REVIEW

Detection of Pathogenic *Escherichia coli* in Samples Collected at an Abattoir in Zaria, Nigeria and at Different Points in the Surrounding Environment

Escherichia coli is part of the natural microflora of the digestive tract of human and animals but certain strains have evolved the capability to cause a wide range of diseases. *E. coli* has a biphasic lifestyle and can effectively survive either in the host or in the environment where it is released with human sewage and animal excreta. Pathogenic *E. coli* with a zoonotic origin, such as STEC, can also be released in the environment with the discharges from slaughterhouses. The abattoir effluents serve as an excellent medium for bacterial multiplication because of its content of faecal matter and blood from slaughtered animal. Waste material is washed off with water from the abattoir operation and, if the effluent is improperly treated for decontamination, it can contaminate the surrounding environment. In the area concerned by the present study no treatment is applied to the abattoir effluent before it is released in the environment and spills into the small river Koreye. The water from the stream in turn is used to irrigate crops grown at a nearby farm.

STEC uses for specimens to take in different sampling points including the animals slaughtered, the effluent from the abattoir, the water from the river stream and the vegetables grown in the nearby farm in order to verify the possibility that pathogenic *E. coli* from the abattoir could be released in the environment and transmitted to vegetables. We have used the Ridascreen Verotoxin immunoassay kit (R-Biopharm) to screen isolated *E. coli* strains for the production of Shiga toxins (Stx). The choice of the screening approach was due to the lack, in the study area, of the possibility to use the PCR for the detection of virulence genes and was based on previous data published in the literature showing that this commercial method proved as sensitive as the PCR in detecting STEC. Such an approach identified 43 positive specimens collected from all the sampling points, suggesting an extensive environmental contamination with STEC from the abattoir. Unfortunately, only 37 out of the 43 EIA-positive strains survived the long storage before being sent to the European Reference Laboratory for *E. coli* in Rome, Italy, and only eight of these were confirmed as STEC by PCR and Vero cell assay. This finding seems to be in disagreement with how previously published on the performance of the Ridascreen Verotoxin Kit but could be explained by possibility that some of the strains produced factors, different from the Stx, cross reacting with the antibodies used in the EIA. Another possibility to explain the discrepancy between the results obtained with the immunoassay and the following characterization of the isolates as STEC may reside in the long storage the strains underwent before being shipped to the European Reference Laboratory for *E. coli* for further analyses. The strains have been kept for eight months as slant agar cultures at 4 °C and might have lost their stx-phages during the storage. Accordingly, the SubAB-producing strains identified in this study could derive from STEC that have lost the stx-phage. As a matter of fact, the Subtilase cytotoxin has been proposed to be an accessory virulence factor of LEE-negative STEC isolated from human cases of diarrhoea and from animals including cattle and small ruminants. It is interesting to note that one of the three confirmed STEC was isolated

from a cabbage sampled in the farm that used the water from the stream to irrigate the crops. The STEC had the same stx genes profile of the other two STEC isolated from the animals at the slaughterhouse. Additionally, the two SubAb-positive *E. coli* strains were isolated from the abattoir effluent and from carrots grown at the same farm. These observations suggest that the transfer of pathogenic *E. coli* from the animals to the crops could have occurred through the water contaminated by the effluent from the slaughterhouse. This hypothesis is supported by previous reports describing the presence of *E. coli* O157 in the water of the same river and the identification of bacterial counts above the recommended levels into water bodies in Abuja, Nigeria, due to the release of untreated abattoir wastewater. We have also screened the *E. coli* strains for other known virulence factors of *E. coli* causing intestinal disease in humans. Interestingly, one of the strains isolated from the abattoir effluent, was positive for the presence of *aggR* and *aatA* genes, the genetic determinants of the Enteroaggregative *E. coli* (EAggEC). According to the literature, EAggEC are highly adapted to humans, suggesting that the human population is their reservoir. Additionally, the isolation of EAggEC from animals including cattle and abattoir effluent has been unsuccessfully attempted in different studies. In the abattoir visited in the present study, the isolation of an EAggEC is noteworthy and could be the result of contamination deriving from the workers. In fact, the absence of hygiene and standard operating procedures in this operation has been previously reported. Interestingly the isolated EAggEC was positive to the Ridascreen Veroytoxin immunoassay. Given the mentioned possibility that the strains under investigation may have lost the stx-phages during the storage, we could have isolated an Enteroaggregative Haemorrhagic *E. coli* (EAHEC). These strains are EAggEC producing Stx that have made their appearance in the 90's and caused sporadic cases of infection in different countries and at least three epidemics in Europe, with one of them being the most severe STEC outbreak ever reported.

III. NON-INFLAMMATORY DIARRHEAS CAUSE BY ENTEROTOXIGENIC ESCHERICHIA COLI

Clinical manifestations.

The diarrheal disease caused by Enter toxigenic *Escherichia coli* (ETEC) is characterized by a rapid onset of watery non-bloody diarrhea of considerable volume, accompanied by a little or no fever other common symptoms are abdominal pain, malaise, nausea, and vomiting. Diarrhea and other symptoms cease spontaneously after 24 to 72 hours.

IV. INFLAMMATORY DIARRHEAS CAUSED BY ENTEROINVASIVE, CYTOTOXIC, AND ENTEROPATHOGENIC ESCHERICHIA COLI

Clinical Manifestation

Diarrhea caused by the enteroinvasive, Cytotoxic, and enteropathogenic strains of *Escherichia coli* ranges from Very mild to severe illness as usually protected and accompanied by fever. Infection with few serogroups is characterized by bloody diarrhea. (Hemorrhagic colitis).

V. GENERAL SYMPTOMS OF E.COLI

Symptoms of infection with *E.coli* 0157 typically appear 3 to 4 days after being exposed to the bacteria. However, symptoms may appear as early as 24 hours or as late as 1 week later.

These can include:

- Abdominal pain or severe abdominal cramping.
- Watery diarrhea few hours after the pain begins.
- Bright red bloody stool.
- Nausea and in some cases vomiting.
- Fatigue, resulting from dehydration and loss of fluids and electrolyte

VI. AIMS

To determine Diarrhea cause by Escherichia Coli

VII. OBJECTIVES

1. To determine the pathotypes that are associated with diarrhea
2. To identify the causes of E.coli infection
3. To provide preventive measures on E.coli infection

VIII. METHODOLOGY

This paper is a review paper, that uses secondary source for data. All the data were collected from journals, text books and other national bailees.

IX. RESULT AND DISCUSSION

The six pathotypes are associated with diarrhea and collectively referred to as diarrhiagenic Escherichia coli

- Shiga toxin producing E. coli (STEC) – STEC may also be referred to as verocytotoxin producing E coli (VTEC) or enter hemorrhagic E. coli (EHEC).
- Enterotoxigenic E. coli (ETEC)
- Enteropathogenic E. coli (EPEC)
- Enteroaggregative E. coli (EAEC)
- Enteroinvasive E. coli (EIEC)
- Diffusely adherent E. coli (DAEC)

X. SHIGA TOXIN PRODUCING E. COLI (STEC)

E. coli are bacteria producing shiga toxin. The bacteria that make these toxins are called shiga toxin producing E. coli. shiga toxin producing Escherichia coli infection causes infection to people of any age very young children and elderly are more likely to develop severe illness and hemolytic uremic syndrome (Hus) than others, but even healthy order children and young adult. can become seriously ill.

XI. SYMPTOMS OF SHIGA TOXIN PRODUCING E. COLI

The symptoms of shiga toxin producing E. coli infections vary for each person but often include

- Severe stomach Cramps.
- Diarrhea (often bloody)
- Vomiting
- Fever (usually, not very high)

XII. ENTEROGENIC ESCHERICHIA COLI (E. COLI) OR ETEC

Is an important cause of bacterial diarrhea illness, infection with enterotoxigenic *Escherichia coli* (ETEC) is the leading cause of traveler's diarrhea and a major cause of diarrheal disease in lower income countries, especially among children, enterotoxigenic *Escherichia coli* (ETEC) is transmitted by food or water contaminated with animal or human feces. Infection can be prevented by avoiding or safely preparing foods and beverages that can be contaminated with the bacteria, as well as washing hands with soap frequently.

XIII. SYMPTOMS OF ENTEROTOXIGENIC E. COLI

- Severe diarrhea
- Dysentery
- Abdominal Cramps
- Fever

Enterotoxigenic can be life threatening due to significantly fluid loss and severe dehydration.

XIV. ENTEROPATHOGENIC ESCHERICHIA COLI (EPEC)

Enteropathogenic *E. Coli* causes intestinal infections in infants in the developing world. Infection typically spreads through contaminated food and water which may lead to watery diarrhea. The enteropathogenic *E. coli* attached to the intestinal epithelial cells and directly injects virulence factors which modulate multiple signaling pathways leading to host cell dysfunction. Therefore the molecular mechanism that regulate the onset of diarrhea or poorly defined of a major target of the enteropathogenic *E. coli* (EPEC) is the host cell tight junction complex which act as barriers and regulates the passage of water and solutes through the paracellular space.

XV. SYMPTOMS OF ENTEROPATHOGENIC

- prolonged diarrhea in children in poor countries.
- Dehydration include dry mouth, decreased urination or dizziness.
- Vomiting.

XVI. ENTEROAGGREGATIVE ESCHERICHIA COLI (EAEC)

Enterotoxigenic *Escherichia coli* (EAEC) is a subgroup of diarrhoeagenic *E. coli* (DEC) that during the past decade has received increasing attention as a cause of watery diarrhea, which is often persistent. Enterotoxigenic *E. coli* (EAEC) have been isolated from children and adult worldwide. that definition of Enterotoxigenic *e coli* (EAEC) is the ability of microorganism to adhere to epithelial cells such as HEP – 2 in a very characteristic stacked bricks pattern.^[1]

XVII. SYMPTOMS OF ENTEROAGGREGATIVE E. COLI

- Watery diarrhea with or without blood or mucus.
- Abdominal pain
- Nausea and vomiting
- low grade fever.

XVIII. ENTEROINVASIVE ESCHERICHIA COLI (EIEC)

Enteroinvasive *Escherichia coli* is an intestinal pathogen causing enteritis, with a similar pathogenic mechanism to that of shigella which causes an epithelial invasion. the large

bowel feeding to information and ulceration of the mucosa. The patients often develop the symptom of bacillary dysentery. The enteroinvasive *E. coli* strains are typical in their biochemical reactions and may ferment lactose late or not at all, are lysine decarboxylase negative, and non motile. in addition most enteroinvasive *E. coli* strains express somatic antigens which are either strongly related or identical to shigella antigen.^[1]

XIX. SYMPTOMS OF ENTEROINVERSIVE E. COLI

- Watery diarrhea
- Blood to stool
- mucus in stool
- Chills
- Malaise
- Fever
- Abdominal pain, cramps
- Vomiting

XX. DIFFUSELY ADHERANCE ECHERICHIA COLI (DAEC)

Diffusely Strains are defined by a pattern of diffuse adherence (DA), in which the bacteria uniformly cover the entire cell surface. The implication of diffusely adherence *Escherichia coli* (DAEC) strains in diarrhea remains controversial since some studies have reported that these strains are found similarly in children with and without diarrhea. Diffusely adherence *Escherichia coli* where unable to conclusively induce diarrhea in adult volunteers but suggested that diffusely adherence *Escherichia coli* may cause disease in immunologically naïve or malnourished children. Discrepancies among exdeniological studies could be explained by age dependents susceptibility to diarrhea or by use of appropriate detection method such as DNA probing.

XXI. SYMPTOMS OF DIFFUSELY ADHERANT ESCHERICHIA COLI

Escherichia coli is expelled into the environment within a fecal matter. the bacterium grows massively in fresh fecal matter under aerobic conditions for 5 days but it's numbers decline slowly afterwards *Escherichia coli* and other facultative and overs constitute about 0.1% of gut flora, and Fecal oral transmission is the major route through which pathogenic strains of the bacterium cause disease. cells are able to survive outside the body for a limited amount of time, which makes them potential indicator organisms to test environmental samples for fecal contamination. A growing body research though has examined environmentally persistent *E. coli* which can survive for extended periods outside of a host.

The bacterium can be grown and cultured easily and inexpensively in a laboratory setting, and has been intensively investigated for over 60 years. *Escherichia coli* is a chemoheterotrophic whose chemically defined medium must include a source of carbon and energy. Organic growth factors included in chemically defined medium used to grow *Escherichia coli* include glucose, ammonium phosphate, monobasic, sodium chloride, magnesium sulfate, potassium phosphate, dibasic, and water. The exact chemical composition is known for media that is considered chemically defined medium. *Escherichia coli* is the most widely studied prokaryotic model organism, and an important species in the fields of biotechnology and microbiology where it has served

as the organism for the majority of work with recombinant DNA. under favorable conditions, it takes only 20 minutes to reproduce.

XXII. CAUSES OF ESCHARICHIA COLI INFECTION.^[4]

1. Swallowing contaminated water: tap water that is contaminated with the strains of Escherichia coli can cause infection.
2. Private wells can be a source of infections as can some lakes and swimming pools.
3. Traveler`s to places where water may be untreated should be careful when drinking water, using ice or eating vegetables washed in water of Uncertain origin.
4. Swallowing contaminated food: possibly sources of infection which include:
 - a. Undercooked ground beef, unpasteurized milk, juice, cider, or cheese, alfalfa sprouts or raw vegetables.
 - b. infected people who work in restaurants and o not wash their hands property after going to toilet can spread that infection to customers and other members of staff.
 - c. Person to person contact: Good hand hygiene is important is stopping the spread of infection.
5. Contact with animals: Bacteria can spread in farms, petting zoos, and fares.

XXIII. PREVENTION

The following are prevention measures of Escherichia coli infections cooking meat well, especially ground meat.^[4]

- drinking pasteurized milk, apple juice and order, rather that unpasteurized.
- Washing vegetable, especially leafy green once.
- Ensuring that cutlery and crockery are thoroughly washed with warm, softy water.
- Storing meat and none meat food separately and using separate cutting boards.
- Following good hand hygiene practice (Good hand hygiene involves washing hands thoroughly with warm water and soap regularly, and especially after using the bath room, after changing diapers before preparing foods, after touching animals.

XXIV. CONCLUSION AND RECOMMENDATION

The research has been made and are making by the researchers to identify the solutions for that problems, therefore, the advices given by the researchers include, there is no cure for E. coli, it has to resolve itself. And antibiotics are not advised, get rest and drink excessive of water to prevent dehydration.

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