

Transmission of Escherichia coli O157: H7 to cattle by house flies

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Abstract

The aims of this study were to determine the prevalence of and characterize E. coli O157: H7 associated with houseflies. *Musca domestica* was collected from different sites on a cattle farm over a 5- month period and processed individually for E. coli O157: H7 isolation and quantification. E. coli T O157 counts ranged from 5×10^2 - 5×10^7 CFU among positive houseflies. Microbial resistance of five different antimicrobial agents revealed that all the E. coli O157: H7 isolates from all isolates were resistant to one or more of antimicrobial agents.

انتقال بكتريا ايشيرشيا كولون الأبقار بواسطة ذبابة المنزل

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المستخلص

استهدفت الدراسة الحالية التعرف على ظهور وسائط E. coli O157:H7 المصاحبة الذباب المنزلي *Musca domestica* في جميع الثواب المنزلي من مواقع مختلفة لتفول الأبقار على مدار خمسة اشهر ومعالمتها كذا على عدة اعزل بكتريا E. coli O157:H7 والتعريف بالخصائص الفيزيائية والكيميائية ل E. coli O157:H7 من 5×10^2 - 5×10^7 اولى الثواب المنزلي موجداً ظهورها جميع عزلات E. coli O157:H7 وذلك المواقع المدروسة مقاومتها للمكروبية لو احد أو أكثر من خمسة جندبات ميكروبية مختلفة.

Introduction

Enterohemorrhagic *Escherichia coli* (EHEC) has emerged in recent years as the predominant cause of hemorrhagic colitis in humans. This illness, with characteristic symptoms of bloody diarrhea and abdominal cramps, can progress into a more severe, life-threatening complication known as hemolytic uremic syndrome (HUS). The pathogenicity of EHEC appears to be associated with a number of virulence factors, including the production of serum cytotoxins^{1,2}. These toxins are collectively referred to as serotoxins in *Shiga-like toxins* (SLTs) because the SLT-1 of *E. coli* closely resembles the *Shiga toxin* of *Stigolita dysenteriae* type 1³. Although more than 60 *E. coli* serotypes produce SLTs⁴ and more are being identified as capable of producing SLT, serotype O157:H7 is the predominant pathogen in the EHEC group and the one associated most frequently with human infections worldwide. The isolates (mostly *Escherichia coli* serotypes) in general are considered to be zoonotic sources of many kinds of zoonosis such as bacteria^{5,6}, protozoa⁷, viruses⁸ and helminth eggs^{9,10}. In recent outbreaks of enterohemorrhagic colitis in nursery schools in Japan, the epidemiologic survey isolated enterohemorrhagic *Escherichia coli* O157:H7 (EHEC-O157) from both households collected in the school and from patients. The DNA patterns and the flag and serotype were identical in EHEC-O157 isolated from both flies and patients¹¹. This result strongly indicated that houseflies in nursery schools disseminated EHEC-O157 to hosts, dogs, pigs, and humans, although direct evidence of the transmission has not been clarified. The infective dose for EHEC-O157 is considered to be very low. Studies by

Wu, et al. *Stigella flexoris* is a zoonosis^{12,13}. The study was mostly focused on the role of fly in transmission of EHEC *E. coli* and to investigate the development of its resistance to some antimicrobial agents.

Materials and Methods

Houseflies (*Diptera: Muscidae*) were collected by sweepnet from different sites on nearby fields in College of Agriculture in Tbilisi University four times per month from mid-June until the end of October 2006. Fifty flies were randomly selected and processed for *E. coli* O157 isolation and quantification. Individual flies were homogenized in 1 ml of phosphate-buffered saline (pH 7.2) and serially diluted. Dilutions were plated by a direct drop plate technique into serial 10x MacConkey agar with cefixime (25 µg/l). Plates were incubated overnight at 37°C, and lactose fermenter colonies with serology characteristics of *E. coli* O157 were tested for O157 antigen by the latex agglutination assay. Colonies positive for the O157 serogroup were counted, and one pure colony, microbial resistant for Ampicillin (10 µg/ml), Chloramphenicol (30 µg/ml), Tetracycline (30 µg/ml), and biochemical tests for *E. coli* O157:H7 were confirmed according to Scott et al¹⁴ and Cronon¹⁵.

Results

A total of 78 samples of *E. coli* were isolated from the housefly which collected from different sites on a cattle field of College of Agriculture in Tbilisi University from January till the end of May 2006. Data revealed during the period of the study that there was a significant ($p < 0.05$) difference in the percentage of

percentage of 8, with Q_{157} H7 between the different months of study. The total mean microbial counts demonstrate that the total number of Q_{157} is equal to 3.76×10^7 CFU/g of honey (Table 1). Microbial resistance of five different antimicrobial agents

(A, T, S, C, C) revealed that all the E. coli Q_{157} H7 isolates from all isolates were resistant to one or more of antimicrobial agents (Table 2). Results showed that 22 (33%) of positives were resistant to ampicillin and tetracycline while 36 (53.5%) were resistant for penicillin and only 9 (13.5%) were resistant for those antibiotics.

Table (1): Total number of isolated E. coli Q_{157} from honey at the period of the study

Month	Total No. of positives	Percentage of isolates	Mean of microbial count (CFU/g of Q_{157})
January	4/12	66	5×10^7
February	7/10	70	6×10^7
March	26/34	76	2.5×10^7
April	15/18	83	2×10^7
May	11/12	91	2.3×10^7
Total	67/76	88	3.76×10^7

Table(2): Antibiotic Resistance pattern for isolated E. coli Q_{157}

Antibiotic resistance pattern	No. of resistant isolates	Percentage
1- Resistant for one antibiotic		
A	14	21
T	8	12
Pen	22	33
2- Resistant for 2		
AT	15	22
TS	7	10.7
AN		

Age	8	9
Total	3	7.5
Gender	7	4.5
Total	16	25.5
3. Ruminants and birds		
Cattle	8	9
Pigs	3	4.5
Total	9	13.5
Total	47	100

Discussion

Enterohemorrhagic *Escherichia coli* O157:H7 is now known as the major agent of hemorrhagic colitis and hemolytic uremic syndrome in humans.¹⁰ Outbreaks of the food-borne illness caused by *E. coli* O157:H7 have been reported throughout the world.¹¹ In this study, and for the reason that usually in general are considered to be mechanical vectors of many kinds of pathogens, it was used as indicator of contamination of water animals.¹² The main reservoir for *E. coli* O157:H7 is the intestinal tract of healthy cattle, individual cattle are routinely colonized and shed *E. coli* O157:H7 in their feces.¹³ The sources of *E. coli* O157:H7, which infects cattle, are not well understood.¹⁴ Additionally, the high variability in the prevalence of *E. coli* O157:H7 among cattle suggest the possibility of acquisition of *E. coli* O157:H7 external to cattle.¹⁵ However, other than the detection of *E. coli* O157:H7 in ruminant animals, including sheep, horses, pigs and wild birds¹⁶, the ecology of this pathogen has not been extensively studied. Insects, such as houseflies (HF), can develop in manure organs, natural way transmit antibiotic resistant bacteria from the manure of habitats in which it developing, manure) independence,

in other microbial categories, in feeding mechanism (populations), its attraction to human food, and its ability to fly long distances make this insect a very good candidate for dissemination of antibiotic-resistant strains. This study showed that houseflies in a cattle feeder serving facilities carry antibiotic-resistant and potentially virulent *E. coli* O157:H7 that have the capacity for horizontal transfer of antibiotic resistance genes to other bacteria.¹⁷ Multidrug resistance in clinical isolates has antibiotics that are effective in treatment of human infections.¹⁸ It has been suggested that there is a connection between the antibiotic resistance of food animal origin, the antibiotic resistance of clinical isolates, and community health.^{19,20}

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