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Investigation on American cockroaches medically important bacteria in Khorramshahr hospital, Iran

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PEER REVIEW

Peer reviewer

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Comments

It is a good research in which the authors find some important pathogenic bacterial species on the outer body surface of American cockroaches in the Khorramshahr hospital. This finding can evidence a role in bacterial transmission by cockroaches that reduce sanitary standards and human health.

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ABSTRACT

Objective: To investigate American cockroaches' infection to various bacteria in Khorramshahr Vali-e-Asr hospital, which was done in 2008.

Methods: In this descriptive cross-sectional study, 20 American cockroaches were caught via direct collection. Medically important bacteria were extracted from their outer surface of bodies by standard procedures.

Results: Culturing outer surface wash of cockroaches resulted in the separation of *Klebsiella*, *Pseudomonas*, *Escherichia coli*, *Staphylococcus*, *Proteus* and *Streptococcus*. The main common bacteria were *Klebsiella* (35%) and *Pseudomonas* (30%). Also, results of culture media showed that about 90% of cockroaches infected to at least one bacterium.

Conclusions: American cockroaches can transmit pathogenic and potential pathogenic bacteria, therefore their presence in hospitals may be a sanitation challenge. It is recommended to assess plans in purpose to combat these pests in the hospitals.

KEYWORDS

American cockroaches, Bacteria, Hospital, Iran

1. Introduction

Cockroaches (Dictyoptera: Blattidae) in the creamery profession transport microorganisms such as *Escherichia coli* (*E. coli*), *Pseudomonas*, *Salmonella*, *Listeria monocytogenes* and conidia of mycotoxigenic fungi. At the domestic level, there is relation between cockroach infestation and standard levels of health[1]. These synanthropic insects may play as potential vectors in the epidemiology of hospital infections, especially the transmission of drug-resistant *E. coli*, *Pseudomonas*

aeruginosa (*P. aeruginosa*), *Klebsiella* spp and so on[2]. Nosocomial infection or hospital infection is acquired after the customer's admission in the hospital and is manifested during his or her remain there or after furlough in case it is linked to hospitalization.

Pursuant to the outcomes of researches, cockroaches can transport 150 bacteria species, 60 yeast species, 90 protozoa species and 45 parasite worms species[3]. Cockroaches can transport to fourteen million bacteria on the body surface and seven million in any excremental droppings[2].

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Cockroaches' excretion has compounds such as cinamic acid, xanthurenic acid and 8-hydroxyquinolonic acid (tryptophan derivatives) that have mutagenic and carcinogenic properties[3].

According to some studies, around all cockroaches collected from hospitals and human dwelling localities carried medically significant microorganisms. In a study from Morocco, the predominant bacteria on American cockroaches were *Klebsiella* spp., *E. coli*, and *Enterococcus* spp[4]. Fathpour *et al.* in a research in Iran showed that 70% of cockroaches collected from hospitals contaminated with *Salmonella* spp. and several of the isolates were resistant to antibacterial drugs[5]. A study in Morocco displayed that all the American cockroaches were collected to carry some species of bacteria on the body surface. The bacteria isolated from *Periplaneta americana* (*P. americana*) L. were *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus* species, *E. coli*, *Enterobacter* spp., *Klebsiella* spp., *Serratia* spp., *Proteus vulgaris* (*P. vulgaris*), *Proteus* spp., *Shigella* spp., and *Salmonella* spp[6]. *E. coli*, *P. aeruginosa*, *Klebsiella* spp and some other possible pathogens have been isolated from cockroaches found in hospitals. Cockroaches have been related with an outbreak of dysentery[7].

In a study about the incidence of bacteria of public health interest transmitted by cockroaches in various food-related places in Spain, the presence of a number of bacteria, such as *Salmonella*, *Enterobacter sakazakii*, *E. coli* and *Klebsiella* were confirmed[8]. In an investigation in Nigeria, the bacteria isolated from American and German cockroaches captured in hospitals, human dwellings and restaurants were *Salmonella* spp, *Shigella* spp, *Staphylococcus aureus*, coagulase-negative *Staphylococcus* spp, *Bacillus cereus*, *E. coli*, *P. aeruginosa*, *Klebsiella pneumoniae*, *Citrobacter freundii*, *Morganella morganii*, *P. vulgaris*, *Proteus mirabilis*, *Enterobacter cloacae* and *Providencia* spp. The antibiotic resistant *Salmonella* spp. and *Proteus mirabilis* had multiple antibiotic resistance indexes ranging from 0.27 to 0.82[2].

The role of cockroaches as mechanical vectors of pathogens is unknown. The objective of this research was, hence, to isolate and identify the common pathogens from the American cockroaches in a hospital in Khorramshahr city, Southwestern Iran, in 2008.

2. Materials and methods

Vali-e-Asr hospital in Khorramshahr city was noticed in this research. This hospital was among the largest public health centers in the city. The samples were gathered by direct collection (sterile hand gloves and containers) from different parts of hospital, laboratory and kitchen. The hunted samples were transferred to a lab in sterile tubes. Totally 20 cockroaches were identified according to the standard and reliable systematic keys. Just whole and alive cockroaches were examined in this study.

Cockroaches were immobilized at 4 °C for 10–20 min. Any cockroach's body washed fully by 5 cc physiological sterile serum. Different selective bacterial media such as eosin methylene blue agar, blood agar and salmonella shigella agar were applied for culturing bacteria. Bacteriological recognition tests were performed by an expert bacteriologist.

3. Results

Totally 20 American cockroaches were collected and

identified in this research. All of these insects examined in this study. A total of 18 cockroaches (90%) were infected with at least one bacterium and 2 cockroaches (10%) were not infected. A broad spectrum of bacteria, such as, *Klebsiella* spp. (35%), *Pseudomonas* spp. (30%), *E. coli* (15%), *Staphylococcus* spp. (10%), *Proteus* spp. (5%) and *Streptococcus* spp. (5%) were isolated. *Klebsiella* spp. was the most widespread bacteria recovered on cockroaches. *Proteus* spp. and *Streptococcus* spp. had the least prevalent bacteria recovered on their external surface.

4. Discussion

Cockroaches transmit germs to sterilized substances, materials and non-contaminated food in homes and hospitals. They are detected in various hospital parts, because they are attracted by fluids, organic wastages and foods that are commonly depleted in sic places[9].

Our research determined that *P. americana* was one of the major cockroaches in the Valiasr Hospital. In a research directed by Nejati *et al.* in selected hospitals in Hamedan city, Western Iran, they found *Blattella germanica* and *P. americana* were the predominant cockroaches[3]. The attendance of cockroaches in a pathogenic microorganism-rich location like hospitals, is more critical than in a germ-poor location[3].

In the present study, six bacteria species were isolated from external body surface of American cockroaches. *Klebsiella* spp. and *Pseudomonas* spp. were found the maximum bacteria species, respectively. Meanwhile, *Proteus* spp. and *Streptococcus* spp. were found the minimum bacteria species from the cockroaches' external body surface. In Nejati's investigation, 12 bacteria species were extracted from American cockroaches' outer body surface. *E. coli* (40%) and *Staphylococcus epidermidis* (20%) obtained the most[3]. In Vahabi's investigation, the main common bacteria from American cockroaches' outer body surface was *E. coli* (95%), and the second was *Proteus* (75%). Eight bacteria species were diagnosed from American cockroaches' outer body surface[3]. In Vahabi's investigation in human dwelling places of Sanandaj city (Western Iran), seven species of bacteria agents extracted from *Blattella germanica* and *P. americana* including: *Pseudomonas*, *Enterobacter*, *E. coli*, non pathogenic *staphylococci*, *Klebsiella*, *Proteus* and *Serratia*. *E. coli* had the most frequency (61.5%) and *Serratia* (6.1%) had the least[1]. In Fakoorziba's research, the most frequent extracted bacterium was *Klebsiella*[10]. The results of an investigation in a Brazilian health care institution showed that among the enterobacteria, *Klebsiella pneumoniae* was the most prevalent, and it was isolated from 18% of American cockroaches[9]. Isolation of nine pathogenic bacteria from the external surface of American cockroaches caught in health and medical services centers in Khorramshahr County has been reported. *Klebsiella* (47.9%) and *Pseudomonas* (37%) were the most common recognized bacterial[11]. Furthermore, in an investigation done in three hospitals of Ahwaz County, Southwestern Iran, nine species of pathogenic bacteria were extracted. The most frequently bacteria separated in the mentioned study were *E. coli* (86.7%) and *P. vulgaris* (73.3%)[12]. A major subject on the infection rate and species of bacteria links to the sites of cockroach's muster. A study on bacteria carried on the teguments of cockroaches in urban environment of Bangkok, showed that numbers of pathogenic bacteria liked in hospital areas and food handling establishments, while human dwellings contained a negligible bacterial flora[7]. Besides, a favored isolation bacteria from cockroaches relates to the existing materials and instruments.

This issue may be the important cause for diversities among various studies.

In our study, results of culture media exhibited that 90% of cockroaches were positive to the bacteria. In Vahabi's study, all the American cockroaches and 70% of German cockroaches were infected to at least one bacterium^[3]. In Nejadi's study, nearly 75% of American cockroaches had at least one bacteria species on their external surface^[3]. Results of Feizhaddah's study showed that all the American cockroaches were positive for at least three bacterial^[2]. In Kassiri's study, Pathogenic bacteria were isolated from the external surfaces of 100% of the American cockroaches examined^[11]. In Vahabi's research, 74% of entrapped cockroaches had bacterial infection^[1].

The separation of pathogenic bacterial agents from these domestic pests in hospitals and residential regions reveals that cockroaches can set health difficulties to people. Also, cockroaches with great rate of medically important bacteria may cause bacterial epidemic disease in hospitals. Furthermore, some individuals are allergic to their faeces particles. Thus, intervening procedures for control of cockroaches, such as Integrated Vector Management should be noticed.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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Comments

Background

American cockroaches are among the most frequent domestic pests of hospitals, which not only contaminate food but also transmit pathogenic microorganisms, including bacteria. In this regard, the present study was done in a hospital in southwestern Iran.

Research frontiers

To investigate the species richness and relative abundance of pathogenic bacteria carried by American cockroaches in a hospital of Khorramshahr County, Iran in 2008.

Related reports

In the study of bacterial contamination in hospital environment cockroaches (Vahabi 2007), eight bacteria species were isolated from American cockroaches' external body surface, which is in agreement with this study.

Innovations & breakthroughs

In this research, six bacteria species were isolated from American cockroaches for the first time in the hospital of this county. Also, *Klebsiella* and *Pseudomonas* were the most abundant bacteria species isolated from *Periplaneta*

americana.

Applications

The results of present study on the bacterial contamination of cockroaches could be helpful in the understanding of epidemiology of nosocomial infections.

Peer review

It is a good research in which the authors find some important pathogenic bacterial species on the outer body surface of American cockroaches in the Khorramshahr hospital. This finding can evidence a role in bacterial transmission by cockroaches that reduce sanitary standards and human health.

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