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REGIONAL EVALUATION OF BACTERIAL CONTAMINATION IN HOSPITAL ENVIRONMENT COCKROACHES

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ABSTRACT

Cockroaches play an important role in transmission of different diseases either mechanically and occasionally biologically. The aim of current study was on the identification of cockroaches and their contamination to different bacteria in two hospitals affiliated to the Kordestan University of Medical Sciences which was performed in 2003. Cockroaches were collected from different parts using sticky traps, direct collection, and by means of vacuum cleaner. Collected cockroaches were identified according to the reliable systematic keys. Some of the collected cockroaches were selected randomly for the presence of bacteria in their external parts as well as in the digestive tract using specific culture media. Totally 450 specimens were collected. From which 44.4% identified as American Cockroach, *Periplaneta Americana* and remaining German cockroach, *Blattella germanica.* Among collected cockroaches 58 specimens of German cockroaches and 40 American cockroaches were selected to search for the presence of bacteria. Results of culture media exhibited that 89.8% (88.98) of cockroaches were positive to the bacteria. The bacteria were found mainly on external parts (67%) and remaining from alimentary canal. The main common bacteria was found *Escherichia coli*, however, only 5.1% was E*scherichia sp*., which was found on external parts. Among two hospitals it is found that Tohid hospital was more infected (97.5%). In the hospitals the infectivity of American cockroaches was more prevalent than other species. All the American cockroaches and 70% of German cockroaches were infected to at least one bacterium. Result showed that the presence of cockroaches in the hospitals can threaten the health of hospitalized patients. Both cosmopolitan species was found infected in the hospitals. Sanitation of different departments as well as different method of control is recommended in the context of Integrated Vector Management for cockroach control.

Key word: Cockroaches, bacteria, hospital, Kordestan

INTRODUCTION

Insects have the largest variety of specimens among the entire animals, according to scientific finding, 80% of the known animal's specimens in the world are insects. Cockroaches are of the most successful with highest history of life, which have been existed since Pennsylvanian period (beyond Carboniferous period) (Atkinson, *et al*., 1991; Salehzadeh, 1992; Daly, *et al*., 1998; Mohammadi, 1998; Cochran, 2001). They always affect human's health, they are known as one of the most important agents in transmission and distribution of many different bacteria, viruses, protozoa and fungi to human life, and they are intermediate host for some pathogenic intestinal worms (Cloarec, *et al*., 1992; Kopanic, *et al*., 1994). According to the results of extensive researches, cockroaches are naturally able to transmit more than 40 bacterial specimens and they can be infected by some other lab bacteria (Ash and Greenberg,1980; Cornwell and Mendes, 1981). The above agents can stay alive for a few days on different external parts of cockroach's body and in this way they can be

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transmitted to human environment. Therefore with contact to the external surface of cockroach's body different diseases can be transferred. Their excrement as well as their external contaminated body can also infect food, hospital's equipments and human places. Hence they can put the human's health in danger (Baumholtz, *et al*., 1997). This is why the existence of the cockroach at any places is dangerous for community's health and it can be threatening to the environment. The current study was done to identify the cockroaches and their infection to different bacteria in two hospitals affiliated to the Kordestan University of Medical Sciences in 2003.

MATERIALS AND METHODS

This investigation was done in two educational hospital environments affiliated to the Kordestan University of Medical Sciences, which are located in Sanandaj City (Tohid and Beasat hospitals), Iran. The statistical samples were the collected cockroaches from different places of the above hospitals. The samples were collected by sticky traps, direct collection and vacuum cleaner from different parts of hospitals like kitchen, restaurant, basements, cloth cabinets, shelves and corridors. The collected samples were transferred to a refereed lab in sterile tubes. Total of 450 samples were identified according to the reliable systematic keys. Among the hunted samples 98 samples including 58 German cockroaches, *Blattella germanica* and 40 American cockroaches, *Periplaneta americana* were selected to search for bacterial contamination. To investigate the external contamination, any cockroach's body was washed thoroughly by 5 cc physiological sterile serum (sample for external part of the body). The next step was to remove the external contamination by washing the cockroach's body with Ethylic Alcohol for 2 minutes. To remove the Alcohol's effect, the body was lined in physiological sterile serum for around 2 to 3 minutes. The digestive organ of each cockroach was separately extracted in a sterile condition and a homogenous suspension of it was prepared in 5 cc physiological sterile serum (internal sample). To culture and microbiological investigation, the prepared samples including internal and external samples were inserted to bacterial culture media (EMB made by ATD Co. UK, Ballad Agar and SS made by Merck Co. Germany). Bacteriological diagnosis tests were done by a bacteriological expert. The cockroaches having either internal or external contamination were labeled as infected cockroaches. The collected data and the tests results were analyzed statistically by SPSS software.

RESULTS

From the total of 450 collected cockroaches collected from two hospitals of Sanandaj, two cockroach's specimens including 200 (44.4%) American cockroaches and 250 (55.6%) German cockroaches were identified. Among the total samples, 98 cockroaches including 58 German cockroaches and 40 American cockroaches were randomly selected. This is done to investigate the bacterial contaminations among these two groups. It is found that among the latter group, the total number of 88 (89.8%) cockroaches were infected while just 10 (10.2%) of them were not infected. Among the infected cockroaches, 29 (33%) were infected internally (digestive tract) and 59 (67%) were externally infected (external part of their body were infected). The most common diagnostic bacterium was found to be *Escherichia coli* at which 76.3% of cockroaches were infected while no internal contamination was reported by this bacterium. The second common diagnosed bacterium was found to be *Proteus* at which 50.8% external and 32.2% internal infection by this bacterium were reported. The least contamination was approved to *Escherichia*. Only 5.1% of cockroaches were externally infected. No Staphylococcus and Enterobacter was found in digestive tract of any cockroaches (Table 1).

Bacterial infection distribution between two different hospitals showed that the most infected cases with 97.5% were belonged to Tohid hospital. In this hospital 63.3% of the infections were external and 34.2% of them were diagnosed from digestive tract of the colleted cockroaches. In comparison 47.7% of cockroaches were infected externally and just 10.5% were internally infected (Table 2). It was also found that the infection rate in American cockroaches was higher than that of German ones. The entire American and 70% of the German investigated cockroaches were found to be infected with at least a bacterium. In this case 95% of American cockroaches were infected by *Escherichia coli* and 75% of them were infected by *Proteus* (Table 3).

Table 1: Bacterial infection rates of hospital cockroaches in Sanandaj in terms of type of infection

Sample surface bacterial species	External No. (Percent)	Internal No. (Percent)	Total No. (Percent)
Proteus	(50/8) 30	(32/2) 10	(44/4) 40
Pseudomonas	(25/4) 15	(32/2) 10	(27/8) 25
Klebsiella	(42/3) 25	(16/1) 5	(33/3) 30
Escherichia coli	(76/3) 45	-	(50) 45
Bacillus G^+	(33/9) 20	(16/1) 5	(27/8) 25
non pathogen Staphylococcus	(15/2) 9	-	(10) 9
G^+ Cocci	(5/1) 3	(9/7) 3	(6/7) 6
Enterobacter	(16/9) 10	-	(11) 10
Escherichia	(5/1) 3	-	(3/3) 3
Total infected Cockroaches	(67) 59	(33) 29	(100) 88

Table 2: Bacterial infection rates of hospital cockroaches in Sanandaj in different hospitals

Infection hospital	Internal No. (Percent)	External No. (Percent)	Non-infected cockroaches	Total No. (Percent)
Tohid	(34/2) 27	(63/3) 50	(2/5) 2	(100) 79
Beasat	(10/5) 2	(47/4) 9	(42) 8	(100) 19
Total	(29/6) 29	(60/2) 59	(10/2) 10	(100) 98

Table 3: Bacterial infection rates of hospital cockroaches in Sanandaj in terms of specimens

Cockroaches specimen bacteria	American (N=58)	German (N=40)	Total No. (Percent)
Proteus	(75) 30	(17/2) 10	(40/8) 40
Pseudomonas	(37/5) 15	(17/2) 10	(25/5) 25
Klebsiella	(62/5) 25	(8/6) 5	(30/6) 30
Escherichia coli	(95) 38	(12/1) 7	(45/9) 45
Bacillus G^+	(37/5) 15	(17/2) 10	(25/5) 25
non pathogen Staphylococcus	(22/5) 9	-	(9/2) 9
G^+ Cocci	(7/5) 3	(5/2) 3	(6/1) 6
Enterobacter	(5) 2	(13/8) 8	(10/2) 10
Escherichia	(5) 1	(3/4) 2	(3/1) 3

DISCUSSION

The results of this investigation showed that two certain specimens including German and American cockroaches are the main active cockroaches in the hospitals of Sanandaj city, which is consistent with the results of research in Zanjan, Tehran, Mashhad, Sari and Kashan (Mohammadi, 1998; Ash, Greenberg, 1980; Karimizarchi, Vatani, 2000 and Droudghar, *et al*., 1989). It seems that these specimens are also the main active cockroaches in Iranian hospitals. Since an extensive number of cockroaches were infected simultaneously with two or three different types of bacteria, one can easily notice the importance of cockroach's role in transmission of pathogen's agents such as bacteria. In this investigation 9 different types of bacteria was detected from cockroach's body. The most frequent bacterium was *Escherichia coli* and the least common one was *Escherichia.* The result of investigation in Zanjan's hospitals introduced 25 bacteria specimens (Mohammadi, 1998) while it is 4 in Tehran's hospitals (Karimizarchi and Vatani, 2000) and finally from cockroaches in Kashan's hospitals 8 different types of bacteria was removed (Motavali Haghi, *et al*., 1997). The research on the selected hospitals in Tehran showed that the most common extracted bacterium is *Escherichia coli* some thing is consistent with findings of the current investigation (Karimizarchi and Vatani, 2000). In Fakoreziba's research the most frequent extracted bacterium was *Klebsiella* (Fakourziba, *et al*., 1998). A great deal of this type of bacteria was also found on the samples in this investigation. The result of the current investigation is also consistent with the result of Vatani *et al*., at which different types of bacteria such as *Escherichia coli, Klebsiella, Pseudomonas, Staphylococcus, Salmonella, Shigella* were extracted from American cockroaches of Tehran's hospitals (Vatani *et al*., 2001). Furthermore the result of Zanjan's research on both German and American cockroaches is also consistent with the result of our investigation. The extracted bacteria in the mentioned research were *Salmonella, Shigella, Staphylococcus, Streptococcus, Pseudomonas and Escherichia coli* (Mohammadi, 1998). *The result of a research in Ghana showed that the American* cockroaches of kitchen and suburb area were infected by *Salmonella, Shigella disantry,*

Coliform, Proteus and Pseudomonas (Agbodaze and Owusu, 1989). An important issue on the type and the rate of infections relates to the location of cockroach's collection. The result of this investigation illustrates the fact that the collected cockroaches from Tohid hospital which has an infection ward, are more infected than that of the Beasat hospital (Table 2). On the other hand, a successful separation of bacteria agents from cockroaches strongly depends on the available facilities and equipments. Usage of specific culture media can affect on both diagnose of wider types of bacteria and precise separation of the agents. This can be the main reason behind the probable discrepancies among different investigations. Apparently, a hospital is a place to cure hospitalized patients, but existence of cockroaches with high amount of contaminations to pathogen agents such as bacteria like *Escherichia coli, Klebsiella, Proteus*, can cause bacterial epidemic and it may distribute infections across different wards particularly in infection wards. These can increase dangerous diseases and even transmit weak pathogen agents like *Pseudomonas* to patients with difficulties in their immune system, which threaten the ill and community health (Adibfar, 2000). On the other hand some people are allergic to cockroaches or their excrement dusts. All the above factors can convert the hospital where is initially made to cure diseases, to a place of infection and contamination of people, building and so on to pathogenic agents. Therefore it is necessary to control these insects for providing a clean and healthy place to cure hospitalized patients. The most important option for control of cockroaches is integrated vector management including Sanitation of different departments, proper management of solid either infected or non-infected waste disposal. If one bears the environmental consideration and cockroach's sensitivity in mind, application of low risk pesticide will reduce the harmful health effect of these insects. Since the high amount of cockroaches in hospitals of Sanandai is considering, hence interefering methods for controlling the cockroaches are recommended.

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