Bacterial Contamination of Shopping Baskets and Carts in Supermarkets in Erbil City

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Abstract

In present study fifty samples from ten supermarkets baskets and carts in Erbil City were collected .The bacterial isolates were identified depending on morphological, cultural, and some biochemical characteristics. The results found that the average rate of bacterial contamination of the ten supermarkets baskets and carts was 72% . In present study, 80 isolates of bacteria were isolated which returned to ten species which were 20 isolates of Coagulase negative *Staphylococcus*, 16 *Staphylococcus aureus,* 15 *Klebsiella pneumoniae,* 6 *Bacillus* spp., 5 isolates of each of *Proteus* spp, *Pseudomonas aeruginosa Micrococcuc* spp. and 4 *E. coli*, 3 *Shigella* spp. and one isolate of *Streptococcus* spp*.* . The results of ten antibiotics against bacterial isolates showed that all isolates 100% sensitive to Imipenem , while it were more resistance to Clindamycin and Ampicillin with percentage 58% and 50.9% respectively and Variable susceptibility to other tested antibiotics. Also the ihibitory effect of some disinfectants against isolated bacteria were studied and the results showed that the dish washing liquid, dettol , and laundry detergent have inhibitory effect against all isolates with diameter of inhibition zone ranged between 10-20mm , 8-20mm and 9-16mm respectively .

Key word:-Supermarket basket and carts , Bacteria, Antibiotic sensitivity& Disinfectant.

Introduction

Healthcare-associated infections are an important cause of morbidity and mortality in hospitals. Each year more than 2 million patients acquire healthcare associated infections, resulting in 90,000 deaths and healthcare costs that are estimated to exceed $5 billion (1) .The reservoir of any organism, which may be animate or inanimate objects, in the epidemiology of any bacterial disease is very important (2). The pathogens live and or multiply in the reservoir on which their survival depends. Many epidemiological studies have confirmed that many contaminated surfaces played a major role in the spread of infectious diseases (2, 3). Most people do not know that bacteria are found on many common objects outdoors, in their offices, and even in their homes. Such objects include; playground equipments, kitchen sinks, computer keyboards, escalator handrails, elevator buttons and with the spread of supermarkets and hypermarkets the shopping baskets and carts handles. The latter objects are places that are most touched by the bare hands of people who are in various hygienic conditions.

On the other hand, people believe that bacteria are only present in research labs , hospitals and clinics and thus they have a misleading feeling of security in other places. Lack of knowledge about where germs prowl could be the cause of health problems. In fact 80% of infections are spread through hand contact with hands or other objects (4). Shopping carts and handheld shopping baskets in supermarkets are subject to accidental bacterial contamination through contacts with a variety of food and also placement of children in grocery shopping carts has recently been implicated as a source of infection. Recent studies

have shown that children are at increased risk of both *Salmonella* and *Camplyobacter* infections if they ride in a shopping cart carrying meat products (5, 6). Also other study found that shopping carts and baskets are contaminate with Coagulasenegative staphylococci, *Staphylococcus aureus*, *Pseudomonas* spp. and Gram negative bacilli (7) . However, the level of bacterial contamination on shopping baskets and carts is not a subject of public health concern because of the limited availability of information

Therefore, the present study was conducted to determine the contamination of handheld shopping baskets and carts in several supermarkets in Erbil city with different bacteria that could play a role in the spread of bacterial pathogens by using morphological, cultural and biochemical tests.

Materials and methods
Collection of samples
Fifty swab samples from ten supermarkets baskets and carts in Erbil City were collected and analyzed . Sterile swabs moistened with the sterile normal saline and were rotated over the surface of the supermarket baskets and carts. The sampled swabs were soaked separately in normal saline (8) and incubated at 37 ^{o}C for 24hoursand the ten supermarkets were named SM1 to SM10.

Inoculation in culture media
Streaking and swabbing were done with sterile swabs and inoculated with different culture media such as Nutrient Agar, MacConkey Agar, Blood Agar, Salmonella shigella agar, Eosin Methyl Blue (EMB) ,and Manitol Salt Agar to obtain bacterial isolation for 48 hours at 37 ^{o}C (9).

Examination of culture media
Cultures in solid media were visually inspected for growth rate and colony characteristics (9). Different colonies were sub- culturing on Nutrient Agar and MacConkey Agar and incubated similarly as before.

Microscopic examination
Each obtained isolate was tested by Gram staining, spore staining, capsule staining and motility according to (10).

Biochemical tests
Identification of the tested isolates was done based on some biochemical tests such as Catalase test, Oxidase test, coagulase, IMVIC (Indol production , Methyl red test , Voges-proskauer test and Citrate utilization), Urase and Gelatinase…..etc as described by (11).

Antibiotic susceptibility test
The modified Kirby-Bauer method was carried out to determine the susceptibility of obtained isolates to some antibiotics such as Imipenem (IPM) 10 µg, Cephalothin (CEP) 30µg, Ciprofloxacin (CIP) 5 µg, Netillin (NET) 30 µg, Amoxicillin/ Clavonic acid (AMC)30 µg, Clindamycin (CD) 2 µg, Cefotaxime (CTX) 30 µg, Oxacillin (OX) 30 µg, Piperacilli (PI) 100 µg and Ampicillin (AMP) 10 µg antibiotics as described by (12).

Disinfectant susceptibility test

The susceptibility testing of the commonly used disinfectants such as Ethyle Alcohol 70 % (EA), Dettol 12.5% (D), Dettol Tissue (DT) , Laundry Detergent (LD) by taking of 5 gm in 10ml sterilized distilled water and Dish Washing Liquid (DWL) by taking of 5 ml in 10ml sterilized distilled water were ascertained using agar disk diffusion method (13).

Results and discussion

The average rate of bacterial contamination of the ten supermarkets baskets and carts (SMBC) was 72% and the SM1, SM7 and SM9 were showing the highest bacterial contamination with percentage 100%, while the SM8 was showing the least contamination with percentage 20% (Figure 1). In present study, 80 isolates of bacteria were isolated which returned to ten species of bacteria and the highest bacterial isolates were obtained from SM1 and SM9 which were 16 different isolates ,while the least isolates were obtained in SM8 which were 2 isolates (Figure 2). Most tested (SMBC) were found to be contaminated with mixed growth. Twenty isolates of Coagulase negative *Staphylococcus*, 16 isolates of *Staphylococcus aureus,* 15 isolates of *Klebsiella pneumoniae,* followed by 6 isolates of *Bacillus* spp. and 5 isolates of each of *Proteus* spp., *Pseudomonas aeruginosa , Micrococcuc* spp. and 4 isolates of *E. coli*, 3 isolates of *Shigella* spp. and one isolate of *Streptococcus* spp. were also isolated but in lower frequencies (Figure 3) and this obtained results depended on morphological, cultural, staining and biochemical characteristics of various bacterial species were recorded and these results were similar to that found by (14,15) . Gram +ve and G-ve pathogenic bacteria were isolated and the previous results were expected due to the common vehicle of microbial transmission which is the human hands and fingers. However (17) suggested that, where contaminated surfaces come into even relatively brief contact with the fingers or an inanimate surface, a significant number of organisms can be transferred which can be recoverable onto an agar surface. In present study Gram +ve bacteria were more frequently isolated compared to Gram -ve (Figure 3). These obtained results could be in part due to the fact that survival of Gram +ve species on laminate surfaces is greater than that of Gram negative organisms (17). The roles of these organisms in both nosocomial and community acquired infections have been stressed (18).

Coliform bacteria usually originate from feces and were associated with poor sanitary conditions. Coliform bacteria and *E. coli* detected on the carts may originated from contact with raw foods, birds or other animal feces, contact with fecal contaminated hands or other body parts (5) . It was documented both gram-positive and gram-negative bacteria in the hand-to-mouth transfer during casual activities, it was a well-established fact that isolated bacteria were agents of nosocomial infections and fecal contamination which result of diseases (18). This result shows the frequency of the use and exposure of SMBC to environmental microbes on the hand and skin of the users. This result is in agreement with the findings of (19).

Moreover, the results showed that all isolated bacteria were exhibited complete sensitive to Imipenem (100%) and 78.3% , 75.3% sensitive for Amoxicillin/ Clavonic acid and Ciprofloxacin respectively (Table 1 and Figure 4), while it were more resistance to Clindamycin and Ampicillin with percentage 58% and 50.9% respectively (Table 2 and Figure 5) .Moreover , the results of the present study showed that isolated bacteria gave variable sensitivity to other antibiotics . The antibiotic sensitivity indicates marked resistances of bacterial isolates to commonly used antibiotics. These finding were similar to resistant pattern of bacterial isolates in previous studies presenting public health problem (20, 21). It was found that *S. aureus* and *Steptococcus* spp. were the most resistant bacteria with

percentage 50 %, whereas *Shigella* spp. and *Proteus* spp. were the more sensitive bacteria to antibiotics with percentage 70% and these may be due to that majority of the populace sampled purchases antibiotics in the open markets without any medical prescription, use of wrong concentration and for wrong diseases.

On the other hand, the antibacterial activity of different disinfectants against isolated bacteria were studied and the results showed that the dish washing liquid, dettol , and laundry detergent have inhibitory effect against all isolates with diameter of inhibition zone ranged between 10-20mm , 8-20mm and 9-16mm respectively for each above disinfectant .While the ethyl alcohol and dettol tissue shows very low inhibitory activity ranged between 0-8mm and 0-2mm respectively for both disinfectants (Figure 6)and these results similar to those obtained by (22)and these results may be due to manufacture company and missing of quality control in our country .

The results of this study found that there was a higher contamination rate of SMBC with different pathogenic bacteria. The present findings concluded that SMBC may serve as vehicles of transmission of diseases which could be easily transmitted to the hands, and then from the hands to other areas of the body such as mouth, nose and ears. On the basis of these findings, it was suggested that routine cleaning of SMBC with one of the dettol , dish washing liquid or laundry detergent may aid the fight against infection. Also, strict adherence to infection control and precautions such as hand washing and good hygienic practice among the users to prevent the possibility of diseases.

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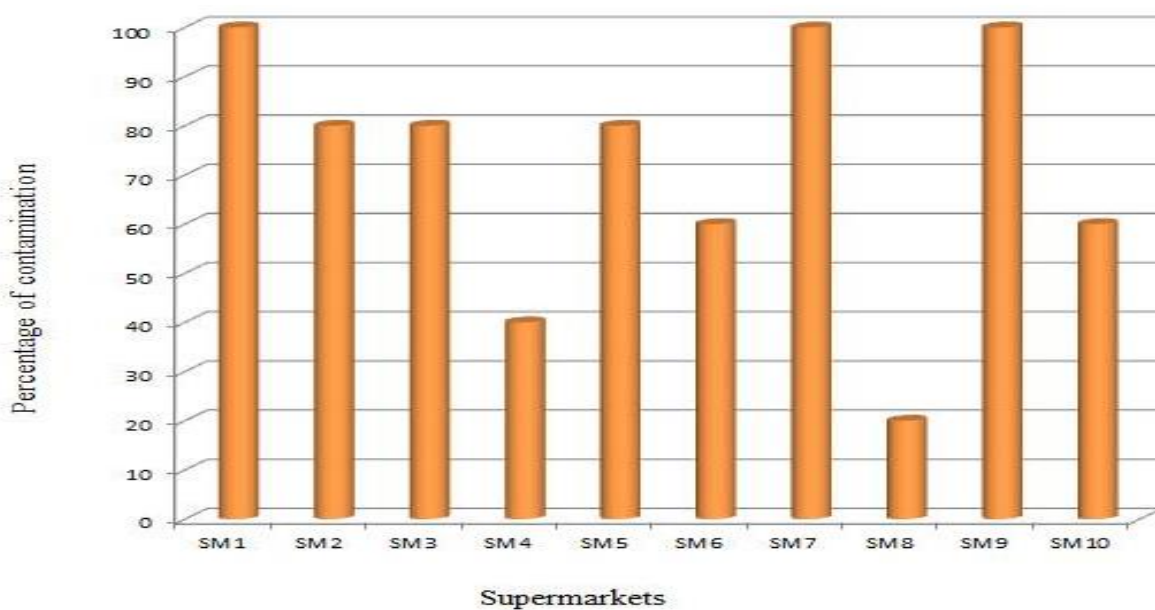
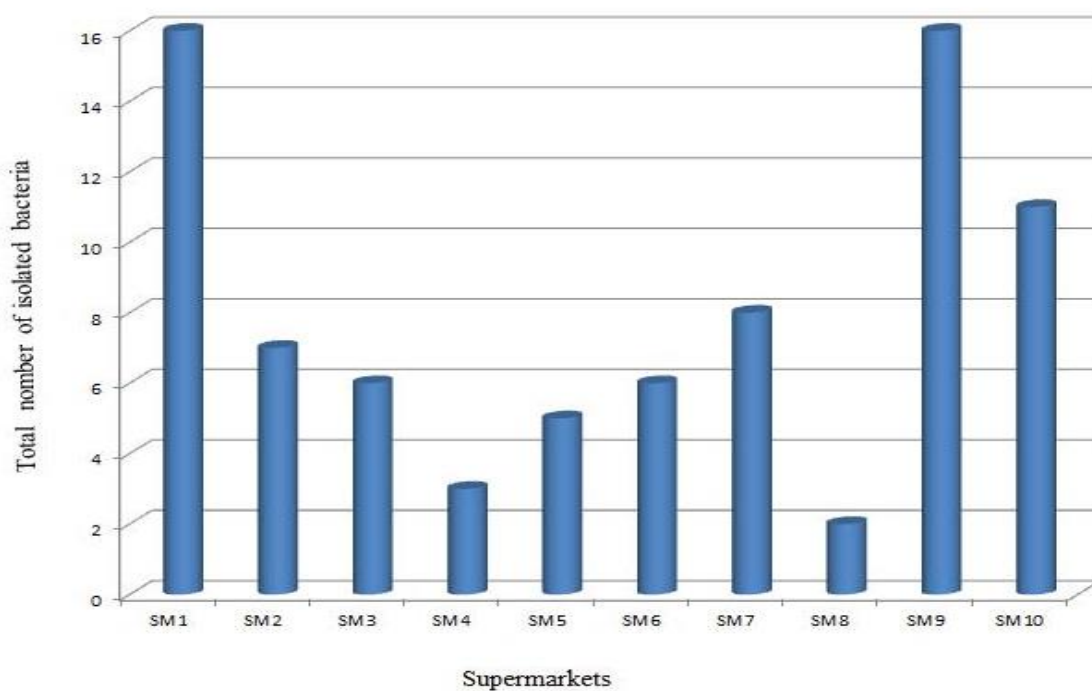**Figure (1): Percentage of bacterial contamination in each supermarket.**

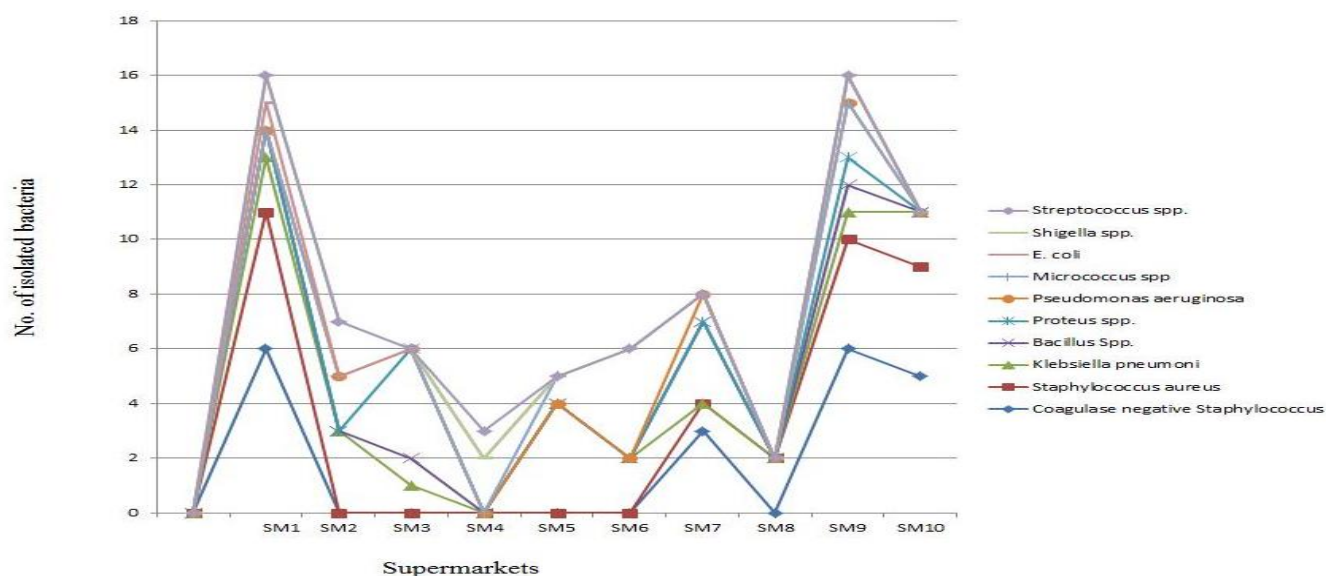**Figure (2): Total numbers of bacterial species in each supermarket.**

Figure (3) : Prevalence of isolated bacteria in each supermarket.

Table (1): Percentage of sensitive isolates to ten antibiotics .

Bacterial Species	CIP	PI	AMP	CEP	AMC	NET	IMP	CTX	CD	OX	Total
Coagulase negative *Staphylococcus*	80	50	60	70	90	60	100	70	30	40	65
Staphylococcus aureus	50	50	37.5	50	87.5	31.3	100	37.5	25	31.3	45.5
Klebsiella pneumoniae	73.3	40	66.7	66.7	86.7	53.3	100	66.7	20	40	61.3
Bacillus spp.	66.7	50	50	66.7	83.3	50	100	50	33.3	33.3	58.3
Proteus spp.	80	80	40	40	100	60	100	60	60	80	70
Pseudomonas aeruginosa	80	60	60	80	100	40	100	60	40	40	66
Micrococcus luteus	60	80	60	80	80	60	100	40	20	60	64
E. coli	75	50	50	100	75	75	100	75	25	50	67.5
Shigella spp.	66.7	66.7	66.7	100	66.7	100	100	33.3	66.7	33.3	70
Streptococcus spp.	0	100	100	100	100	0	100	0	0	0	50
Total	63.2	62.7	59.1	75.3	78.3	52.9	100	49.3	32	40.8	

Table (2): Percentage of resistance isolates to different antibiotics.

| Bacterial Species	CIP	PI	AMP	CEP	AMC	NET	IMP	CTX	CD	OX	Total
Coagulase negative *Staphylococcus*	20	50	40	30	10	40	0	30	70	60	35
Staphylococcus aureus	50	50	62.5	50	12.5	68.7	0	62.5	75	68.7	50
Klebsiella pneumoniae	73.3	60	33.3	33.3	13.3	46.7	0	33.3	80	60	43.3
Bacillus spp.	33.3	50	50	33.3	16.7	50	0	50	66.7	66.7	41.7
Proteus spp.	20	20	60	60	0	40	0	40	40	20	30
Pseudomonas aeruginosa	20	40	40	20	0	60	0	40	60	60	34
Micrococcus luteus	40	20	40	20	40	40	0	60	80	40	38
E. coli	25	50	50	0	25	25	0	25	75	50	32.5
Shigella spp.	33.3	33.3	33.3	0	33.3	0	0	66.7	33.3	66.7	30
Streptococcus spp.	0	100	100	100	100	0	0	0	0	0	50
Total	31.5	47.3	50.9	34.7	25.1	37.1	0	40.8	58	49.2	
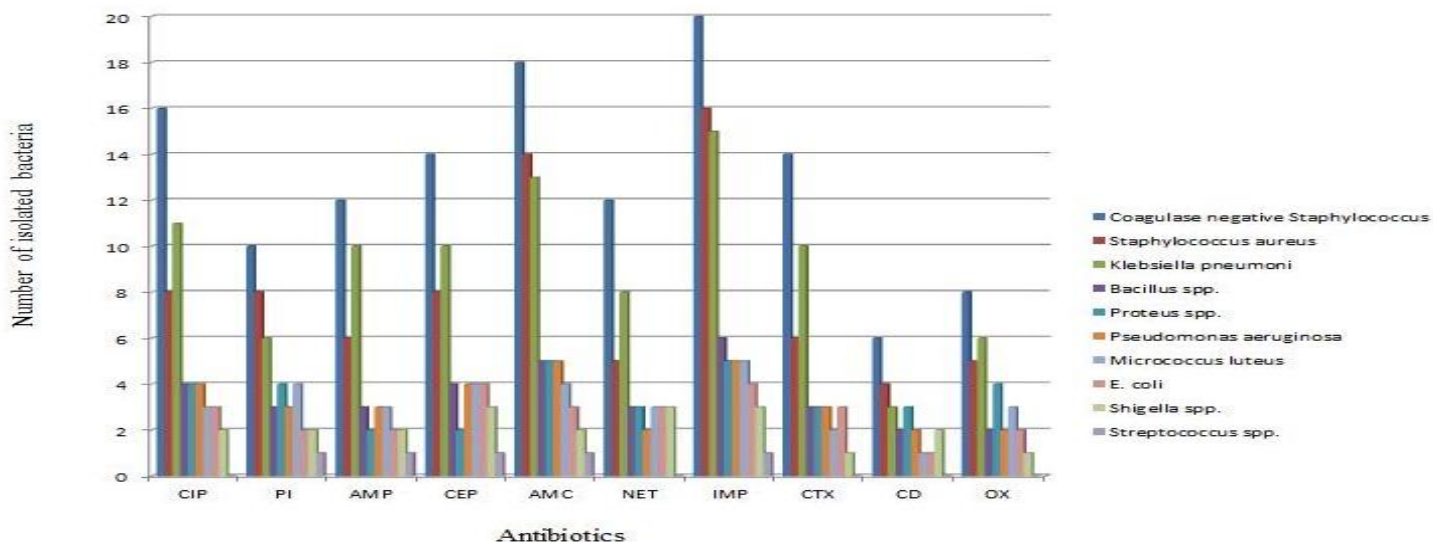
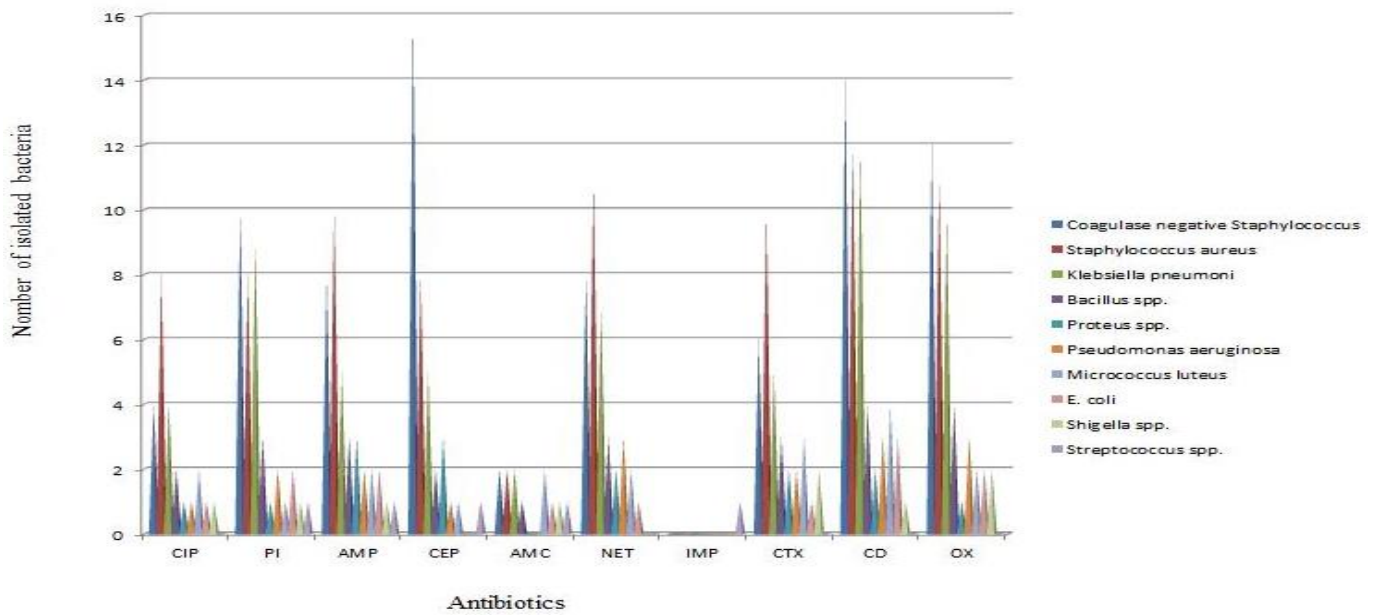**Figure (4): Number of sensitive isolates to ten antibiotics under the study**.

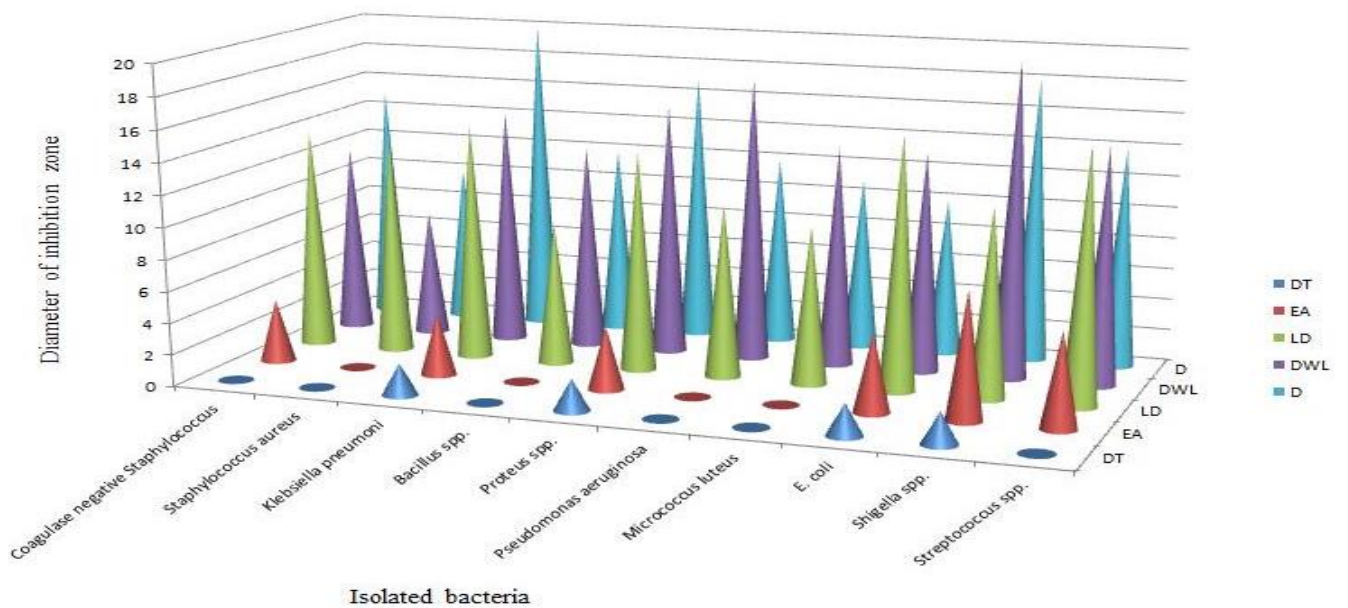**Figure (5): Number of resistant isolates to ten antibiotics under the study**.

Figure (6): Antimicrobial activities of some disinfectants against isolated bacteria

پوخته

ئهم لێکۆلینهوهیه بریتی یه له کۆکرنهوهی 50 نموونه له سلهو عهرهبانهی ده سوپرمارکیت له شاری ههولێر. ههموو جیاکراوهکان دهست نیشان کران بهپێ تاقیکردنهوهی سیفاتی مۆرفۆلۆجی و کێلگهی ورووالهتی و ههندێک سیفههتی کیمیاوی زیندهوهری. ئهنجامهکان دهریان خست که ناوهنده ڕێژهی پیس بوونی سلهو عهرهبانهی ده سوپرمارکیت بریتی بوو له ٧٢٪ . ههشتا جیا کراوه له بهکتریا که دهگهڕێنهوه بۆ ٢٠ جیاکهرهوه له Coagulase negative *Staphylococcus* ، *Staphylococcus* 16 *aureus* ، *Klebsiella pneumoniae* 15، *Bacillus* spp. 6 ، وه ٥ جیاکهرهوه له ههریهك له *Proteus* spp, Pseudomonas aeruginosa *Microccucc* spp. وه ٤ جیاکهرهوهله *E. coli* ، *Shigella* spp. 3 وه یهك جیا کراوه له *Streptococcus* spp . ههروهها ههستیاری ههموو جیاکراوهکان بۆ ده دژه زیندهکی پشکێزان وه ئهنجامهکان دهریان خست که ههموو جیاکراوهکان ههستیاری تهواویان 100%نیشان دا بهرامبهر Imipenem ، بهلام بهرگریان نیشان به بهرامبهر به Clindamycinو Ampicillin وه به ڕێژهی 58% و 50.9% بوو یهك له دوای یهك وه ههستیاری جیاوازیان نیشان دا بهرامبهر دژه زیندهکی تر. ههروهها کاریگهری ههندێك له پاکهرهوهکان له راگرتنی گهشهی بهكتریا دراسهت کرا ، وه ئهنجامهکان دهریان خست که ههر یهك له زاهی شوشتنی قاپ ،دیتول و تایت کاریگهری باشیان ههبوو که تیرهی شوینی راگرتنی گهشه ڕێژهکهیان لـه نیوان 10-20mm ، 8-20mm و 9-16mm بوو یهك له دوای یهك.

الخلاصة

تضمنت الدراسة الحالية جمع ٥٠ عينة من سلة وعربة عشرة سوبرمارکیتات في مدينة اربيل . تم تشخيص العـزلات البکتریـة اعتمادا على صفاتها الشكلية والمزرعية و بعض صفات الكيمياء الحيوية. اظهرت النتائج بـان معـدل متوسـط التلـوث البکتيري لسلة وعربة السوبرمارکیتات كانت٧٢ ٪ . عزلت في الدراسـة الحاليـة ٨٠ عزلة تعـود لعشرة انـواع والتي هـي ٢٠ عزلـة مـن Coagulase negative *Staphylococcus*، *Staphylococcus aureus* 16، *Klebsiella pneumonia* 15، *Bacillus* spp. 6 و ٥ عـزلات لكـل مـن *Proteus* spp ، *Pseudomonas aeruginosa*، *Microccucc* spp و *E. coli* 4 ، 3 *Shigella* spp. وعزلة واحدة من *Streptococcus* spp . کما اظهرت نتائج أختبار حساسية العزلات لعشرة مضادات حيويـة بـان جميـع العـزلات حساسـية تامـة ١٠٠٪ لـ Imipenem ، في حـين كانـت العـزلات ابـدت مقاومتهـا تجـاه Clindamycin و Ampicillin بنسبة 58٪ و 50.9% وحساسية مختلفـة تجـاه المضـادات الاخرى . درس ایضا التـاثير المثبط لـبعض المعقمات ضـد البکتریا المعزولة وقـد اظهرت النتائج التـاثیر المثبط لکل مـن زاهي غسل المـواعین ، الـدیتول ومسحوق التایـت بتکوینقطر منطقـة التثبیط تراوحت بين 10-20mm ، 8-20mm و 9-16mm على التوالي .