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Antibiotic Resistance of *Staphylococcus Sp.* Isolated from Air, Surface, Food and Clinical samples Collected from Baghdad Hospital

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Abstract:

*Staphylococcus Sp.*is the most common type of bacteria found in contamination place, we design this study to compare the contamination accident between two hospitals in Baghdad.One of them isthe Burns Specialist Hospital in the Medical CityinRusafa and another one is Al-Karama Hospital in Karkh. The samples were collected fromOperativeWard No1 (OW1), Operative Ward No2 (OW2), Consulting Pharmacy (CP), Emergency Room (ER), Reception Room (RR), Women's Ward (WW) and Men's Ward (MW).The samples were taken from inside each clinical unit, surfaces, food, and air. The results showed that the number of samples containing *Staphylococcus sp.* bacteria is 81, including 45 belonging to Al-Karama Burns Ward Hospital and 36 belonging to the Medical City Hospital, Burns Special Hospital. The results of Medical City Hospital showed that *Staphylococcus sp.*isolates resist many antibiotics, 99.99% of the isolates from patient samples were resistant to(CLR, P, AMP); 92.30% of the isolates from air samples were resistant to(P, MET) and 85.71%of isolates from surfaces and food samples were resist for (AMP, MET). Also the results of Al-KaramaHospital showed that the highest resistance in the *staphylococcus sp.*isolateswere in patient samplesfor (AMP, SXT), in surface samples for (E), in food samples for (E,P) and in air samples for (P) and the resistance rates were 100% to all these antibiotics.

Keywords: Air, Antibiotic, Clinical, Surface, Nosocomial infection, *Staphylococcus sp.*, Susceptibility

Introduction:

Surfaces, air,floors, and patients transmit microorganisms to hospital environments, and this is the main source of different pathogens that may cause Nosocomial infections NIs [1]. Infections acquired in a hospital or health care service unit appearing within 48 hours ormore afterhospitalization or within three days are called Nosocomial infections (NIs)[2].Ventilation system, ventilation community, crowded place,and dust, help spreaddiseases and thus increase infections through sneezing and coughing, high level of movements, and optimal management of the levelhospital environment[3]. Clean air is a basic requirement of life[4]. Contaminated air can cause many type of nosocomial infections such as bacteria, fungi, and viruses NIs.

Many researchers have found that bacteria are much moreimportant in this regard. The most common microorganisms in the hospital preparation or organisms commonly associated with NIs are *Staphylococcus aureus*, Coagulase-negative staphylococci CoNS, *Pseudomonas aeruginosa*, and *E. coli*, and *Klebsiella*[5]. The hospital service environment contains most strains of multidrug-resistant bacteria (MDR)[6].

Indoor air pollution is a major problem in people's daily life. Efficient corrective methods are urgently needed to combat the problem of indoor air quality: bacteria, pollen grains, smoke, humidity, chemical substances, and gases released by anthropogenic activity have adverse health effects on humans. Methicillin-resistant*Staphylococcus aureus*(MRSA) strainsin long-term care facilities are often more associated with colonialism than clinical infection [7].

Almost all beta-lactam antibiotics have no match effect on methicillin-resistant *S. aureus* (MRSA) strains, which have developed a gene that

makes them resistant.Other antibiotic resistance is also common, particularly in MRSA associated with hospitals. The *Staphylococcaceae* family includes *Staphylococcus aureus*, a Gram-positive, coagulase-positive coccus found in healthcare settings. It has been shown that *S. aureus* has acquired resistance to the beta-lactam antibiotics methicillin and other penicillins and cephalosporins through the mecA and mecC genes[8].

The aim of this study is investigating the bacterial quality of indoor environment of hospital to raise awareness and provide a reference point for better service in hospitals.

Materials and Methods:

Sampling techniques:

Sampling procedures

Air samples were taken from seven selected ward suites from the hospital (theBurns Specialist Hospital, Medical City Department, Al Karama Teaching Hospitalthese suites are: Operations ward No1(OW1), Operations ward No2 (OW2), Consulting Pharmacy (CP), Emergency Room (ER), Reception Room (RR), Women's ward (WW) and Men's ward (MW). Bacterial measurements were made by passive air sampling technique any way to settle the plate using 9 cm Petri dishes. In each suite, five Petri dishes were used for 30 minutes.Bacteria were collected on nutrient agar, mannitol salt agar, MacConkey Agar, Sabouraud Dextrose Agar, and Blood agar.

Air samples

The sampling height approaching the human breathing area was 1 meter above the ground and in the middle of the room. To reduce air pollutant relief, openings such as doors and windows, including the mechanical ventilators, were closed during sampling. In addition, the movement of people during sampling was limited to avoid air disturbance. Analyses were performed using both quantitative and qualitative methods. The main goal of the quantitative analysis was to determine the bacterial load, or the total number of bacteria present in the interior air of the room. To determine the load, exposed culture media/air samples were taken to the laboratory and incubated at 37 °C for twenty-four-hours. After a twenty-four-hour incubation period, bacteria were enumerated as colony-forming units (CFU) and CFU/m3 were identified by the Formula[9]:

$$N=5a*10^{4}(b\ t)^{-1}$$

Where N = microbial CFU/m3 of indoor air; A = number of colonies per Petri dish; b = surface of the dish (Cm^2); and t = exposure time (minutes). Besides, ANOVA and Chi-square method were also conducted to get the average concentration of bacteria from the wards.

The European Commission Report established the following limits for bio-aerosols: 0 undetectable, 1-499 CFU/m^3 low, 500-999 CFU/m^3 medium and > 1000 CFU/m^3 high[10].

Surface samples

Smear samples were collected from the seven suites mentioned earlierinside thehospital. And from eachward seven swabs were taken from different sites depending on the type of ward and the devices present in the suite.

Afterward, the samples were delivered to the laboratory, each swab was immersed in liquid nutrient broth (BHI) and incubated at 37 ± 1 °C for 24 h. Growth was observed, swabs were implanted in nutrient agar, mannitol salt agar, MacConkey Agar, Sabouraud Dextrose Agar, and Blood agar.

Then it was embraced at 37 ± 1 °C for 24 hours. Characteristic colonies were isolated and purified by sub-implantation in a fresh and incubated medium at 37 ± 1 °C for 24 h to isolate the pure strain in accordance with the recommendations of Meunier et al [11] modifying this method by cultivating the swabs immediately after placing them in the nutrient solution (BHI) to obtain the true number of bacteria present on the surface.

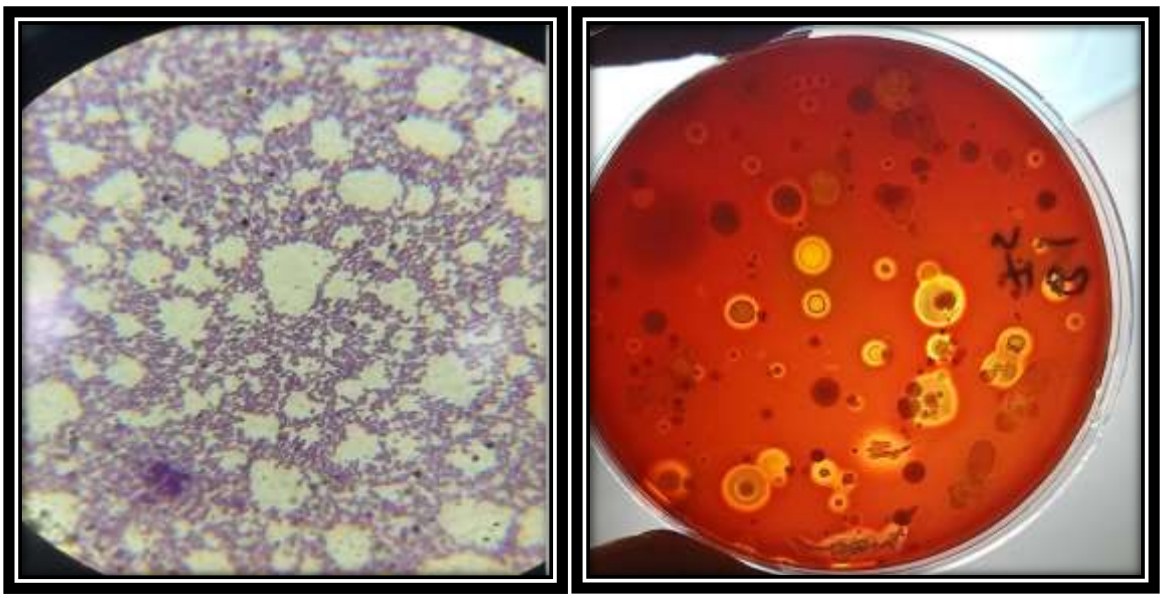
Clinical samples

Eighteen clinical samples were collectedfrom patients with burn injuries who were treated at the Burns Specialist Hospital, Medical City Department, and Al Karama Teaching HospitalComplex Burn specialized hospital.

Bacterial Diagnosis

-Microscopical and Morphological Diagnosis

Staphylococcus sp. was identified as gram positive bacteria, which appeared microscopically as cocci with diploids, tetrads and clusters like aggregation. The *S. aurous* was present on blood agar as smooth, yellow or off - white colonies, which showed varying degrees of growth and exhibited β-hemolysis after 24-48 hour of incubation as shown in Fig.1.



A **B**

Figure 1. A-Gram staining of Staphylococcus sp. Gram positive bacteria under componund microscope(100X) and B-bacteria grown on mannitol salt agar, after incubation at 37ºCfor 24 hours.

-Biochemical Tests

Biochemically, *Staphylococcus* is shown in Table.1 and the test included with the result of *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus hominis and Staphylococcus* saccharolyticus. This test involved aerobic growth (thioglycolate), growth on NaCl agar 10%(w/v) and 15%(w/v), urease, coagulase (rabbit plasma), hemolysis, deoxyribonuclease (DNase agar)[11].

Table 1. Characteristics differentiating the species of the genus Staphylococcus.

No.	Characteristics	S.aureus	S.epidermidis	S.hominis	S.saccharolyticus
1	Aerobic growth(thioglycolate)	+	+	+	-w
2	Growth on NaCl agar 10%(w/v)	+	w	w	ND
	15%(w/v)	w	-	-	ND
3	Urease	+w	+	+	ND
4	Coagulase (rabbit plasma)	+	-	-	-
5	Hemolysis	+	-w	-w	-
6	Deoxyribonuclease (DNase agar)	+	-w	-w	ND

(-): Negative (+): Positive (w): weak reaction (-w): negative to weak reaction (+w): positive to weak reaction (ND): Not Detected.

Antimicrobial Susceptibility Testing

In order to isolate the antimicrobial susceptibility profile, the Kirby–Bauer agar disc diffusion method was used. The chosen suspension of the test organism is made from similar colonies. Comparisons with McFarland Barium choride solutions 0.5[12]. were used to estimate suspension densities. It was dropped into the broth and then accelerated throughout the entire Muller–Hinton Agar plate, sterile swabs were used (Oxoid, LTD). The antibiotic tablets were then incubated at 37°C for 18–24 hours on inoculated agar. Tablet growth inhibition and interpretation were assessed using ICLSI-recommended methods, with results reported as inhibition diameters (CLSI)[13]. The drugs tested were ciprofloxacin 5 µg, gentamicin 10 µg, tetracycline 30 µg, methicillin 5 µg, chloramphenicol 30 µg, ceftriaxone 30 µg, noroxacillin 10 µg, agmentin 30 µg. Ampicillin 10 µg, penicillin 10 IU, erythromycin 15 µg, trimethoprim 25 µg, doxycyclin 30 µg, kalindamisin 2 µg, and clarithromycin 15 µg[13].

Results:

The total samples were taken from both hospital (Medical City, Karama) 81 sample for the *Staphylococcus sp.* Samples represented by 36

samples from the Medical City Hospital divided between patient samples 9 and samples from surfaces 7 and others from food 7 in addition to air samples 13 and 45 samples from the KaramaHospital divided between patient samples 9 and samples from surfaces 13and others from food 10in addition to air samples 13.

The results showed that there were differences in antibiotic resistance. The highest resistance to bacteria was isolated from the Medical City Hospital for patient samples. The results showed that the highest resistance to the following antibiotics (AMP, P, CLR) where the resistance rate was 99.99%, followed by samples isolated from the air with a resistance rate of 92.30% to (P, MET), followed by samples isolated from the surfaces with a resistance rate of 85.71% to (CLR), and samples isolated from the food with a resistance rate of 85.71% to (AMP, MET).
as shown in Table. 2 and Fig.2.

Table2. Resistance of *Staphylococcus sp*. isolated from Medical city Hospital of clinic, surface food and air against various antibiotics, shown in %. And Chi-square analysis.

NO.	Type of Antibiotics		Clinical	(χ^2)	Surface	(χ^2)	Food	(χ^2)	Air	(χ^2)
1	E-Erythromycin(15mg)	R	7(77.77%)	7**	2(28.57%)	0.00	1(14.28%)	0.3	9(69.23%)	9**
		S	0(0.00%)		2(28.57%)		2(28.57%)		0(0.00%)	
2	CN-Gentamicin(10mg)	R	8(88.88%)	5.4**	2(28.57%)	1.2	1(14.28%)	3.5*	2(15.38%)	6.2**
		S	1(11.11%)		5(71.42%)		6(85.71%)		11(84.61%)	
3	DXT-Doxycylin (30mg)	R	2(22.22%)	0.00	2(28.57%)	1.2	2(28.57%)	1.2	4(40.00%)	1.3
		S	2(22.22%)		5(71.42%)		5(71.42%)		8(61.53%)	
4	Nor-Norfloxacillin(10mg)	R	8(88.88%)	5.4**	2(28.57%)	1.2	2(28.57%)	0.6	3(3.90%)	3
		S	1(11.11%)		5(71.42%)		4(57.14%)		9(69.23%)	
5	CLR – Clarithromycine(15 mg)	R	9(99.99%)	9**	6(85.71%)	6**	5(71.42%)	1.2	9(69.23%)	3
		S	0(0.00%)		0(0.00%)		2(28.57%)		3(3.90%)	
6	CD_ Clindamycin (2mg)	R	8(88.88%)	8**	2(28.57%)	0.3	1(14.28%)	0.3	2(15.38%)	0.00
		S	0(0.00%)		1(14.28%)		2(28.57%)		2(15.38%)	
7	CRO-Ceftriaxone (30mg)	R	8(88.88%)	8**	2(28.57%)	1.2	1(14.28%)	1	2(15.38%)	2.7
		S	0(0.00%)		5(71.42%)		3(42.85%)		7(53.84%)	
8	AMP-Ampicillin (10mg)	R	9(99.99%)	9**	7(71.42%)	7**	6(85.71%)	3.5*	11(84.61%)	6.2**
		S	0(0.00%)		0(0.00%)		1(14.28%)		2(15.38%)	
9	C Chloramphenicol(30mg)	R	9(90.00%)	9**	2(28.57%)	1.2	2(28.57%)	1.2	10(76.92%)	5.3**
		S	0(0.00%)		5(71.42%)		5(71.42%)		2(15.38%)	
10	TET-Tetracycline(30mg)	R	5(55.55%)	2.6	2(28.57%)	1.2	2(28.57%)	0.6	4(30.76%)	1.9
		S	1(11.11%)		5(71.42%)		4(57.14%)		9(69.23%)	
11	P-Penicillin (10IU)	R	9(99.99%)	9**	6(85.71%)	3.5*	5(71.42%)	1.2	12(92.30%)	9.3**
		S	0(0.00%)		1(14.28%)		2(28.57%)		1(7.69%)	
12	MET-Methicillin (5mg)	R	7(77.77%)	4.5**	6(85.71%)	6**	6(85.71%)	3.5*	12(92.30%)	12**
		S	1(11.11%)		0(0.00%)		1(14.28%)		0(0.00%)	
13	CIP-Ciprofloxacin(5mg)	R	8(88.88%)	5.4**	2(28.57%)	0.6	1(14.28%)	0.3	2(15.38%)	1.2
		S	1(11.11%)		4(57.14%)		2(28.57%)		5(38.46%)	
14	SXT Trimethoprim(25mg)	R	8(88.88%)	5.4**	3(42.85%)	0.1	1(14.28%)	2.6	4(40.00%)	1.3
		S	1(11.11%)		4(57.14%)		5(71.42%)		8(61.53%)	
15	AUG-Augmentin (30mg)	R	8(88.88%)	5.4**	4(57.14%)3	0.1	4(57.14%)	0.1	7(53.84%)	0.07
		S	1(11.11%)		(42.58%)		3(42.85%)		6(46.15%)	

*(P<0.05)-sig., **(P<0.01)-H.sig., 0.00: non-significant
R: Resistant and **S**: Sensitive

The results showed that there were differences in antibiotic resistance, which was the highest resistance to bacteria isolated from the Karama Hospital for patient samples. The results showed that the highest resistance to the following antibiotics in a clinical sample (AMP, SXT), (E) for

surface sample, (E, P) for food sample, and (P) for air sample where the resistance rate was 100.00%to the antibiotics mentioned above. as shown in Table.3, and Fig.3.

Table3.ResistanceofStaphylococcus*p*. Isolated from Karama Hospital of clinic, surface food and air against various antibiotics, shown in %. And Chi-square analysis.

NO.	Type of Antibiotics		Clinical	(χ^2)	Surface	(χ^2)	Food	(χ^2)	Air	(χ^2)
1	E-Erythromycin(15mg)	R S	8(88.88%) 0(0.00%)	8**	13(100.00%) 0(0.00%)	13**	10(100.00%) 0(0.00%)	10**	8(60.53%) 3(23.07%)	2.2
2	CN-Gentamicin(10mg)	R S	7(77.77%) 2(22.22%)	2.7	6(46.15%) 7(53.84%)	0.07	7(70.00%) 3(30.00%)	1.6	6(46.15%) 6(46.15%)	0.00
3	DXT-Doxycylin (30mg)	R S	5(55.55%) 3(33.33%)	0.5	5(38.46%) 8(61.53%)	0.6	6(60.00%) 4(40.00%)	0.4	5(38.46%) 8(60.53%)	0.6
4	Nor-Norfloxacillin(10mg)	R S	7(77.77%) 2(22.22%)	2.7	6(46.15%) 7(53.84%)	0.07	3(30.00%) 7(70.00%)	1.6	7(53.84%) 6(46.15%)	0.07
5	CLR – Clarithromycin(15mg)	R S	5(55.55%) 4(44.44%)	0.1	3(23.07%) 5(38.46%)	0.5	7(70.00%) 3(30.00%)	1.6	12(92.30%) 0(0.00%)	12**
6	CD_ Clindamycin (2mg)	R S	7(77.77%) 0(0.00%)	7**	1(7.69%) 9(69.23%)	6.4**	4(40.00%) 4(40.00%)	0	7(53.84%) 2(15.38%)	2.7
7	CRO-Ceftriaxone (30mg)	R S	7(77.77%) 0(0.00%)	7**	2(15.38%) 7(53.84%)	2.7	5(50.00%) 4(40.00%)	0.1	3(23.07%) 3(23.07%)	0.00
8	AMP-Ampicillin (10mg)	R S	9(100.00%) 0(0.00%)	9**	3(23.07%) 0(0.00%)	3**	8(80.00%) 2(20.00%)	3.6*	10(76.92%) 3(23.07%)	3.7*
9	C Chloramphenicol(30mg)	R S	8(88.88%) 0(0.00%)	8**	7(53.84%) 6(46.15%)	0.07	9(90.00%) 0(0.00%)	9**	7(53.84%) 4(30.76%)	0.8
10	TET-Tetracycline(30mg)	R S	6(66.66%) 2(22.22%)	1.2	4(30.76%) 9(69.23%)	1.9	5(50.00%) 4(40.00%)	0.1	1(7.69%) 9(69.23%)	6.4
11	P-Penicillin (10IU)	R S	6(66.66%) 2(22.22%)	1.2	9(69.23%) 4(30.76%)	1.9	10(100.00%) 0(0.00%)	10**	13(100.00%) 0(0.00%)	13**
12	MET-Methicillin (5mg)	R S	8(88.88%) 0(0.00%)	8**	12(92.30%) 1(7.69%)	9.3	8(80.00%) 1(10.00%)	5.4**	11(84.61%) 2(15.38%)	6.2**
13	CIP-Ciprofloxacin(5mg)	R S	6(66.66%) 2(22.22%)	1.2	6(46.15%) 6(46.15%)	0.00	3(30.00%) 4(40.00%)	0.1	3(23.07%) 7(53.84%)	1.6
14	SXT Trimethoprim(25mg)	R S	9(100.00%) 0(0.00%)	9**	6(46.15%) 6(46.15%)	0.00	6(60.00%) 3(30.00%)	1	7(53.84%) 4(30.76%)	0.8
15	AUG-Augmentin (30mg)	R S	5(55.55%) 4(44.44%)	0.1	6(46.15%) 6(46.15%)	0.00	5(50.00%) 5(50.00%)	0.00	7(53.84%) 6(46.15%)	0.07

*(P<0.05)-sig., **(P<0.01)-H.sig., 0.00: non-significant
R: Resistant and **S**: Sensitive

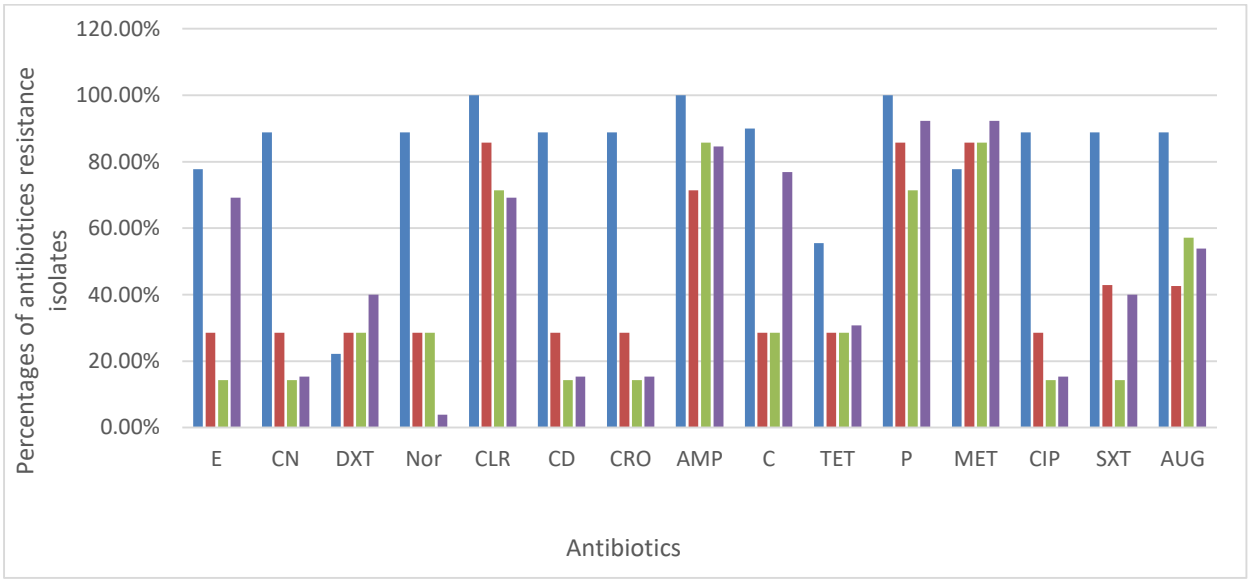


Figure2. Percentages of *Staphylococcus sp.* resistance isolates from Medical city hospital.

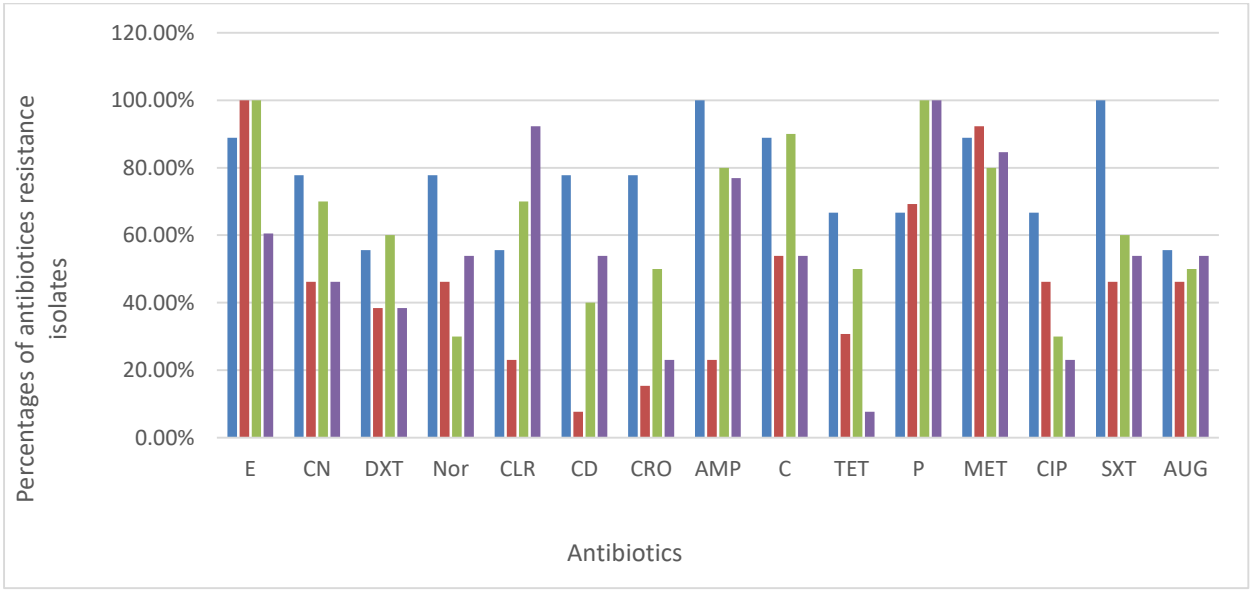


Figure3. Percentages of *Staphylococcus sp* .resistance isolates from Karama hospital.

Discussion:

Antibiotics susceptibility of bacterial isolates was performed on fifteen antibiotics represented by ciprofloxacin 5 µg, gentamicin 10 µg,tetracycline 30 µg, methicillin 5 µg, chloramphenicol 30 µg, ceftriaxone 30 µg, noroxacillin 10 µg, agmentin 30 µg. Ampicillin 10 µg, penicillin 10 IU, erythromycin 15 µg, trimethoprim 25 µg, doxycyclin 30 µg, kalindamisin 2 µg, and clarithromycin 15 µg[13]as described in Table 2,3and Figure 2,3.*Staphylococcus sp.* was resistant to CLR, P, AMP, MET, SXT and E.Moreover, the resistance of local bacterial isolates may be due to the production of beta-lactamase enzymes such as ESBL enzymes, which degrade penicillin and cephalosporins Because physicians and the general public frequently misuse antimicrobial drugs, the antimicrobial susceptibility test has become an essential part of routine practice.

The results showed that there were differences in antibiotic resistance (AMP, P, CLR) where the resistance rate was 99.99% for clinical sample. While the results showed that the highest resistance to the following antibiotics in a clinical sample (AMP, SXT), (E) for surface sample, (E, P) for food sample, and (P) for air sample where the resistance rate was 100.00%to the antibiotics mentioned anabove. This result represents the antibiotic resisting to bacteria isolated from clinical sample for sample isolated from Medical City while the sample isolated from AL-Karama Hospital has high resistant for all types of the samples isolated.

Under certain test conditions, an antibiotic that inhibits the visible growth of the bacterium being studied can be used. Disk diffusion, well

diffusion, Stokes diffusion, and gradient diffusion are all examples of manual diffusion methods that can be used with a variety of experimental setups and save time and money. The development of more advanced, reproducible, automated, and dependable testing methods for antimicrobial resistance is certainly attracting researchers even though currently available methods accurately detect common antimicrobial resistance mechanisms[14].

Antibiotic-resistant *Staphylococci*, particularly MRSA, are now the most common cause of hospital-acquired infections worldwide despite extensive efforts to control resistant organisms through aggressive infection control methods [15]. *Staphylococcus sp.*infections have been documented in Karama and Medical City, two of Baghdad's most well-known hospitals, according to this study. This study uses fifteen types of antibiotics and represents the percentage of the sample and chi-square. Other research on burn wound swabs revealed growth of one, two, or three bacterial pathogens (Bacterial isolates and their antibiograms of burn wound infections in a burns specialist hospital in Baghdad). *P. aeruginosa, K. pneumoniae , S. aureus, A. baumanii, E. coli,* and *Citrobacterfreundii, Providenciastuartii, Enterobactercloacae*all of the bacterial isolates tested positive for drug resistance to at least ten of the 19 antibiotics tested[13]. Staphylococcus bacteria are present in the burn hospital, and they are resistant to a wide range of antibiotics, according to this study.

The rates of antibiotics resistance rising when broad-spectrum antibiotics are used to treat infections. Bacterial resistant to antibiotics are also common[15]. As a result, chemotherapy should be tailored to the sensitivity of the most likely pathogen. *Staphylococcus sp.* should be accurately detected by clinical laboratories, the path of transmission in the community, and the risk factors for infection, such as the use of antimicrobials and parental medications. There will be a problem with *Staphylococcus sp.* in the future because of their ability to change over time, as they have been in the past and still are, at this time. [16, 17].

Conclusion:

Staphylococcus sp. bacteria is contaminates most part of the hospitals under study, and it is found in all types of samples taken from the Medical City Department Hospital, (Burns Specialized Hospital) and Al-Karama (Burn Halls) Hospital from the air, patients, food, and surfaces samples.

Antibiotic resistance to this type of bacteria reaches a high rate about 99.9% and 100.00%. Advanced antibiotics must be used to combat the bacteria spread in burn hospitals and not rely on old antibiotics because of high antibiotics resistance in this type of bacteria.

Conflicts of Interest Authors' declaration:

- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are mine ours. Besides, the Figures and images, which are not mine ours, have been given the permission for re-publication attached with the manuscript.
- Authors sign on ethical consideration's approval
- Ethical Clearance: The project was approved by the local ethical committee in University of Baghdad.
- **Ethics Approval**

  We obtained approvals from the Departmentof Health Baghdad / Al-Rusafa Pursuant to the book No. (5970) in 2021/2/15and the Department of Health Baghdad / Al-Karkh Pursuant to the book No. (70354) in 2021/ 8/22 for the purpose of providing us with laboratory samples from the Medical City Department Hospital, (Burns Specialized Hospital) and Al-Karama (Burn Halls).

Authors' contributions statement:

S. S. conceived the presented idea, worked on it, and conducted laboratory tests, S. R. collected samples, developed the theory, and performed the computations verifying the analytical methods, and A. H. investigated and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

Reference

1. Raycheva R, Rangelova V, Kevorkyan A. Cost Analysis for Patients with Ventilator-Associated Pneumonia in the Neonatal Intensive Care Unit. Healthcare.2022; 10(6);980. https://doi.org/10.3390/healthcare10060980
2. Božić J, Ilić P. Indoor air quality in the hospital: the influence of heating, ventilating and conditioning systems. BrazArch Biol Technol. 2019;62.2.https://doi.org/10.1590/1678-4324-2019180295
3. Abhijith K V, Kukadia V, Kumar P. Investigation of air pollution mitigation measures, ventilation, and indoor air quality at three schools in London. Atmos Environ. 2022; 289.(119303):1-13 https://doi.org/10.1016/j.atmosenv.2022.119303
4. Zhang J, Mauzerall D L, Zhu T, Liang S, Ezzati M, RemaisJV. Environmental health in China: progress towards clean air and safe water. Lancet. 2010;

375(9720): 1110–1119.https://doi.org/10.1016/S0140-6736(10)60062-1
5. Andualem Z, Gizaw Z, Bogale L, Dagne H. Indoor bacterial load and its correlation to physical indoor air quality parameters in public primary schools. Multidiscip Respir Med. 2019;14(1):1–7. https://doi.org/10.1186/s40248-018-0167-y
6. Kayta G, Manilal A, Tadesse D, Siraj M. Indoor air microbial load, antibiotic susceptibility profiles of bacteria, and associated factors in different wards of Arba Minch General Hospital, southern Ethiopia. PLoS One. 2022;17(7):e0271022.https://doi.org/10.1371/journal.pone.0271022
7. Stojanović Bjelić L, Ilić P, Farooqi ZUR. Indoor Microbiological air Pollution in the Hospital. QL (Banja Luka). 2020;18(1–2):5–10.
8. Wang X, Ouyang L, Luo L, Liu J, Song C, Li C, et al. Methicillin-resistant staphylococcus aureus isolates in a hospital of shanghai. Oncotarget. 2017;8(4):6079.https://doi: 10.18632/oncotarget.14036.
9. Gizaw, Z., Gebrehiwot, M., & Yenew, C. High bacterial load of indoor air in hospital wards: the case of University of Gondar teaching hospital, Northwest Ethiopia. Multidiscip Respir Med. 2016, 11(1): 1–7.
10. Ashuro Z, Diriba K, Afework A, Husen Washo G, Shiferaw Areba A, G/meskel Kanno G, et al. Assessment of Microbiological Quality of Indoor Air at Different Hospital Sites of Dilla University: A Cross-Sectional Study. Environ Health Insights. 2022;16.https://doi.org/10.1177/11786302221100047
11. Meunier O, Hernandez C, Piroird M, Heilig R, Steinbach D, Freyd A. Prélèvements bactériologiques des surfaces: importance de l'étape d'enrichissement et du choix des milieux de culture. In: Ann BioClin. 2005. 63(5)p. 481–6.
12. Bauer AW. Antibiotic susceptibility testing by a standardized single disc method. Am J clin pathol. 1966;45:149–58.
13. Arendrup MC, Prakash A, Meletiadis J, Sharma C, Chowdhary A. Comparison of Eucast and Clsi reference microdilution MICs of eight antifungal compounds for Candida auris and associated tentative epidemiological cutoff values. Antimicrob Agents Chemother. 2017;61(6):e00485-17.https://doi.org/10.1128/AAC.00485-17
14. Bergey DH. Bergey's Manual® of Systematic Bacteriology. Vol. 2. Springer Science & Business Media; 2005.
15. Abdulridha S, Alkaabi G. Bacterial Isolates and Their Antibiograms of Burn Wound Infections in Burns Specialist Hospital in Baghdad. Baghdad Sci J. 2013;10(2):331–40.https://doi.org/10.21123/bsj.2013.10.2.331-340
16. Mansouri S, Khaleghi M. Antibacterial resistance pattern and frequency of methicillinresistant Staphylococcus aureus isolated from different sources in south-eastern Iran. Iran J Med Sci. 1997;22(3):89–94.
17. Thwani AN, Mohammed BJ, Ahmad M. Detection of Pseudomonas aeruginosa in Hospital Contamination. Baghdad Sci J. 2008;5(2): 1-4. In arabic.https://doi.org/10.21123/bsj.2008.5.3.353-356

الملف التعريفي للمضادات الحيوية لبكتريا المكورات العنقودية المعزولة من الهواء والسطوح والغذاء والمرضى المجموعة من مستشفيات بغداد

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الخلاصة:

أجريت الدراسة في مستشفيات مدينة بغداد من جانب الكرخ وجانب الرصافة.ثم إجراء مقارنة بين المستشفيات المتمثلة في مستشفى دائرة المدينة الطب (مستشفى الحروق التخصصي) ومستشفى الكرامة (ردهات الحروق). الدراسة كانت داخل وحدات المستشفى المتمثلة في ردهه العمليات رقم 1 وردهة العمليات رقم 2 والصيدلة الاستشارية وغرفة الطوارئ وغرفة الاستقبال وردهه النساء وردهه الرجال. تم أخذ عينات من داخل كل الوحدات المذكورةمنالسطوح، والغذاء، والهواء، والمرضى. وهكذا فإن عدد العينات المعزولة من المكورات العنقودية.تصبح 81 عينة منها 45 تابعة لمستشفى الكرامة ردهات الحروق و36تابعة لمستشفى دائرة مدينة الطب مستشفى الحروق التخصصي. من خلال الدراسة، وجد أن أكثر مضادات الجراثيم مقاومة للمكورات العنقودية هي (CLR، P، AMP) بنسبة 99.99٪ لعينات المرضى، تليها (P، MET) بنسبة 92.30٪ للعينات المعزولة من الهواء وأخيرًا العينات المعزولة من الأسطح والمواد الغذائية بينت المضادات (AMP، MET) نسبة 85.71٪. وكانت أعلى مقاومة للبكتيريا المعزولة من مستشفى الكرامة حيث أظهرت النتائج أن أعلى مقاومة للمضادات الحيوية ا في العينات السريرية للمضادات (E، SX، AMP)) عينات السطوح للمضادات (E، P) عينات الغذاءللمضادات (P) عينات الهواء للمضادات حيث كان معدل المقاومة 100.00 ٪للمضادات الحيوية المذكورة أعلاه.

الكلمات المفتاحية: الهواء، المضادات، المرضى، السطوح، عدوى المستشفيات، المكورات العنقودية، الحساسية