



Antibiotics Susceptibility of Staphylococcus Aureus Isolated from Different Samples in some Medical Laboratories (Thamar City-Yemen).

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Abstract:

The importance of *Staphylococcus aureus*, as a persistent nosocomial and community-acquired pathogen, has become a global health concern. It has a remarkable capability of evolving different mechanisms of resistance to most antimicrobial agents. The aim of the present study was to evaluate the antimicrobial resistance as well as the prevalence of antibiotic resistant *Staphylococcus aureus* in various clinical samples. Two hundred and thirty-eight samples of *S. aureus* obtained from various clinical specimens between January and June 2018 from six laboratories and two hospitals, in Thamar city. In this study, the *S. aureus* was the most common in age group (21-40 years), the pus sample represented the highest source of *S. aureus* isolated with 31.51%. *S. aureus* was highest sensitivity to Piperacillin, Levofloxacin, Doxycycline, Ciprofloxacin and Amikacin, (89.66%, 83.54%, 69.75%. 67.9% and 65.49%, respectively), whereas, it was the highest resistant to Ampicillin, Cefdinir, Amoxicillin, Lincomycin and ceftazidime (100%, 100%, 76.27%, 74.44%, and 53.19% respectively).

Most of antibiotics which revealed high sensitivity to *S. aureus* as Levofloxacin, Doxycycline, Ofloxacin and Piperacillin not used in most Culture\Sensitive test in some laboratories.

Keywords: Key words: Antibiotic, *Staphylococcus aureus*, Sensitivity, Resistant.

Introduction:

Staphylococcus aureus is gram-positive bacteria spherical cocci, arranged characteristically in grape-like Clusters, they are non sporing, non-motile, catalase positive and usually non capsulate with the exception of rare strains. *S. aureus* measuring about (0.5–1.0) m in diameter (Cheesbrough, 2006; Kumar, 2016). It is facultative anaerobic in nature and is normal commensal on skin and in nasal passage. It is the common cause of purulent infections including boils, carbuncles, furuncles, sinusitis, otitis media, food poisoning, osteomyelitis, pneumonia and sepsis (Kumar, 2013).

Resistance to commonly used antimicrobial drugs is frequently encountered with *S. aureus*. Some of the mechanisms in resistance include; inactivation of antibiotics by the enzymes, decreased affinity for the antibiotics caused by alteration of the target, efflux pumps, and trapping of the antibiotic (Pantosti A and Sanchini A, 2007). Antibiotic resistance leads to prolonged hospital stay and increased costs in terms of treatment. In addition to these, it causes life threatening infections such as in cases of pyomyositis and chronic osteomyelitis (Kitara LD et al, 2011).

The problem with *Staphylococcus aureus* became more complicated when it was found that it quickly developed resistance and was capable of producing many antibiotic resistant strains. (Kitara LD et al, 2011). The aim of the present study was to evaluate the antimicrobial resistance as well as the prevalence of antibiotic resistant *Staphylococcus aureus* in various clinical samples.

Materials and methods

Timing and Area of Study

This is a descriptive study of previous archived data from (JAN-JUN / 2018). It was taken from six laboratories and two hospitals in Thamar city, Yemen.

Population, Sampling and Participants:

All patients who were infected with bacteria and did not have a pre-response to the medicine were asked to do a Culture\Sensitive (C\S) test. The number of samples that were collected from various clinical samples were 576. They had been being collected out of eight biological laboratories for six months. The sample data were collected from targeted laboratories's test reports of C\S. The reports contain of sex, age, gram stain, specimen, bacteria and antibiotics. Exclusion not all C/S reports contain complete data.

Table1: The targeted laboratories with number of samples

	Laboratories						Hospitals	
	Medlab	Alpha	Alsaeeda	Al-Haya	Al-Jarfi	Al-Dubae	Al-Mosally	Taiba
Sample	35	82	58	104	34	33	185	45

Ethical Consideration

This study was based on fully coordination and agreement between the Board of the Faculty of Applied science at Tamar University and the Board of hospitals a5nd Laboratories in question regarding providing us with information and reports in a voluntary manner; no problem if the actual names and details were deleted from reports for Privacy affairs.

The Statistical Analysis

These reports involved some information like Age, Sex, Specimen, Bacteria and Antibiotics, and was scheduled by IBM SPSS Statistic 22 software (Analyze, descriptive Statistics, frequency and percentage).

Results

The present cross-sectional study was conducted upon 576 clinical samples found in

Tamar city. The most prevalent bacteria among all clinical samples was *Staphylococcus aureus*, and the most prevalent was pus and urine specimens. Concerning *S. aureus*, susceptibility was found for many antibiotics as Ofloxacin and Ciprofloxacin. Piperacillin was highly sensitive, while Ampicillin and Cefdinir were highly resistant. The details are shown in the figures below.

Prevalence of Pathogenic Bacteria in Tamar City

A total of 576 clinical samples analyze for 6 months. Among the samples, 238 were *S. aureus*, the most prevalent in Tamar city. The results shows the highest percentage for *Staphylococcus aureus* (41.3 %).

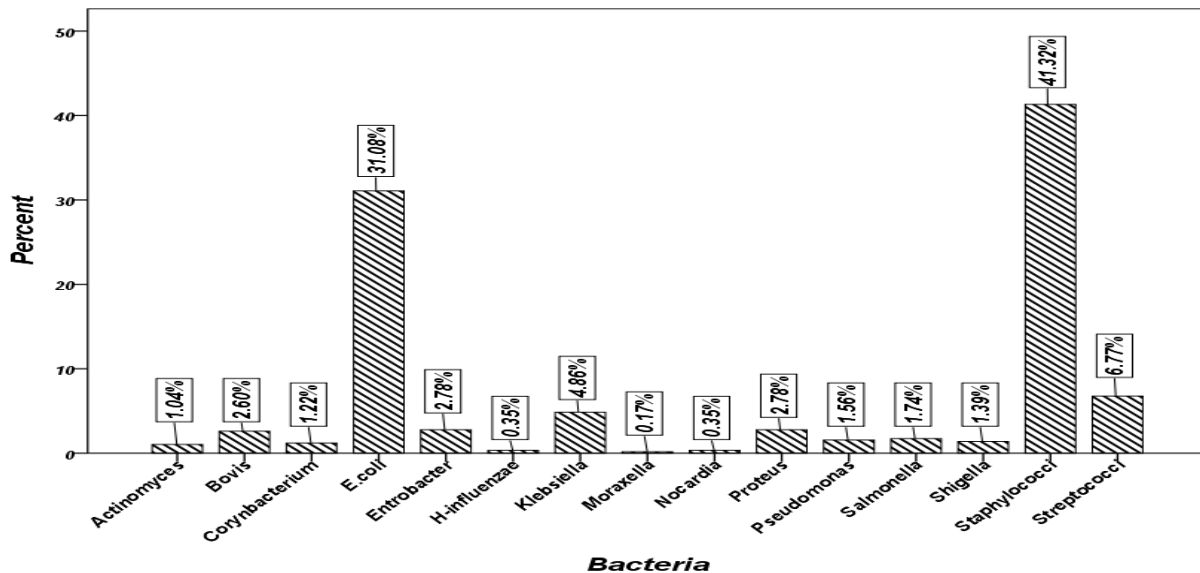


Figure 1: Shows the targeted laboratories with number of samples.

Distribution of *S. aureus* According to Sex

The result shows that females 121/238 (50.8%) have higher infection rate than males 117/238 (49.2%).

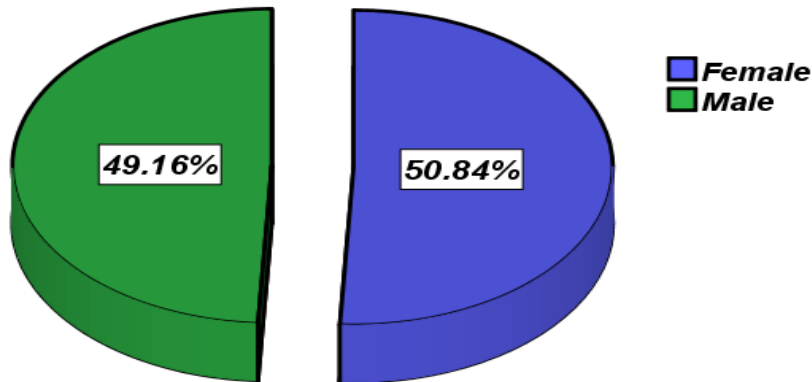
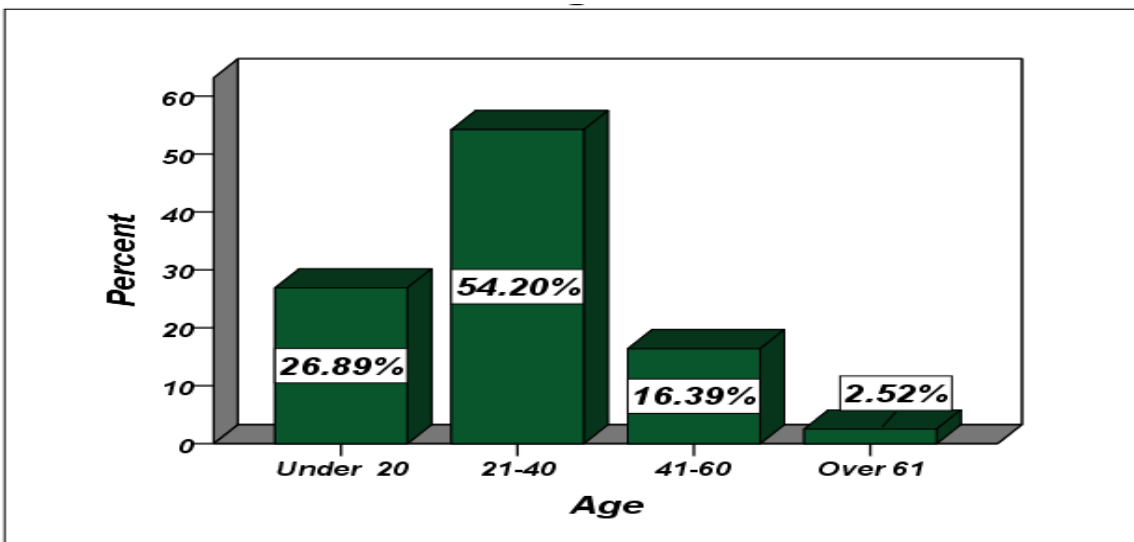


Figure 2: Shows the sex distribution of patients with *S. aureus*.

Distribution of *S. aureus* in Population Based on Age

The results shows that the highest frequency of *S. aureus* occurred in the age group (21-40) years, whereas the lowest was in the age (Over 61) years.



Figure

3: Shows the age distribution of patients with *S. aureus*.

Distribution of *S. aureus* in Population Based on Specimens

The results demonstrate that the highest number of *S. aureus* was found in pus 75/238 (31.5%), while the lowest percentage was found in throat, sputum, and pleural 1/238 (0.4%).

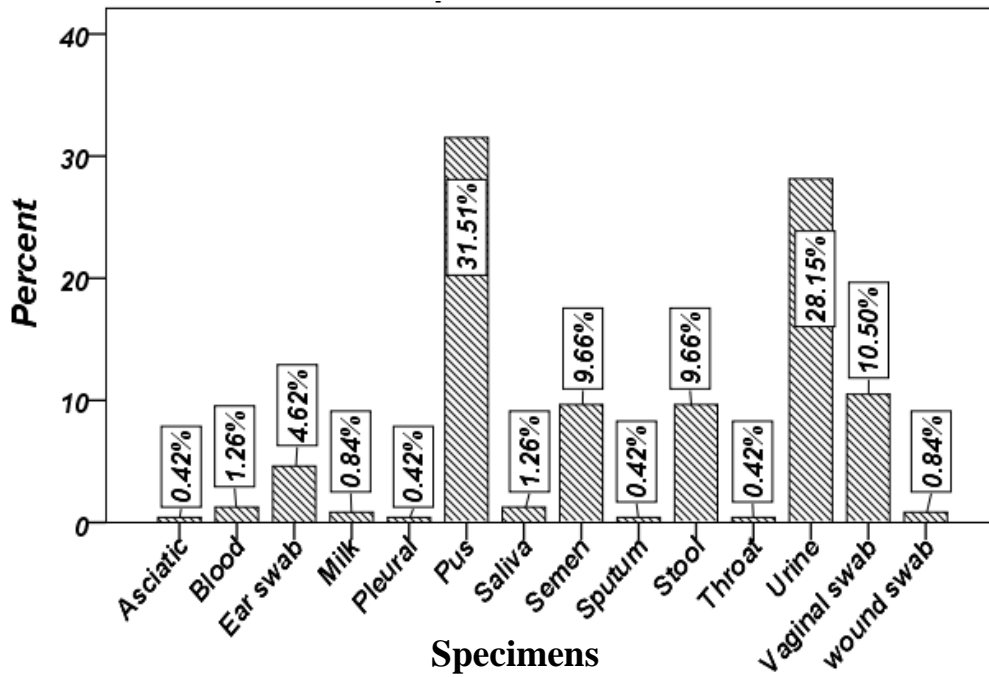


Figure 4: Shows the distribution of *S. aureus* among various clinical sample.

Susceptibility Patterns of *S. aureus*

The study illustrate that 43.15% of *S. aureus* were sensitive to antibiotic, while 32.32% were resistant.

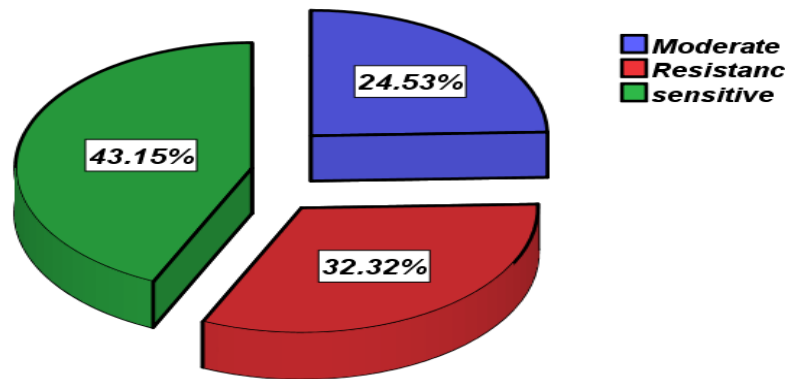


Figure 5: Shows the Susceptibility patterns of *S. aureus* for antibiotic.

Antibiotics Sensitivity and Resistant to *S. aureus*

The highest frequency of sensitivity observes in Piperacillin (89.66%), followed by Levofloxacin, Doxycycline, and Ciprofloxacin, while the lack antibiotic

sensitivity are Amoxicillin, Ampicillin and Cefdinir. The absolute resistant of antibiotics observes in Ampicillin and Cefdinir, while the Piperacillin, Levofloxacin, Ofloxacin and Lomefloxacin were no resistant.

Table12: Shows the antibiotic sensitivity and resistant of *S. aureus* to various antibiotics.

Antibiotics Sensitivity		Antibiotics Resistance	
Antibiotics	Percentage	Antibiotics	Percentage
Piperacillin	89.66	Ampicillin	100
Levofloxacin	83.54	Cefdinir	100
Doxycycline	69.75	Amoxicillin	76.27
Ciprofloxacin	67.9	Lincomycin	74.44
Amikacin	65.49	Ceftazidime	53.19
Ofloxacin	60.87	Erythromycin	52.87
Gentamicin	60.47	Amikacin	15.93
Azithromycin	52.86	Ciprofloxacin	14.81
Lomefloxacin	52.17	Gentamicin	13.95
Vancomycin	40	Doxycycline	9.24
Erythromycin	26.44	Azithromycin	5.71
Ceftazidime	21.28	Vancomycin	4
Lincomycin	15.56	Piperacillin	0
Amoxicillin	0	Levofloxacin	0
Ampicillin	0	Ofloxacin	0
Cefdinir	0	Lomefloxacin	0

Discussions

Staphylococcus aureus is a common bacterium colonizing the human skin and mucous membranes. However, *S. aureus* is also a major causative agent of hospital and community-associated infection that can result in life-threatening disease (Seo *et al.*, 2008; Watanabe *et al.*, 2009). Attempts to control the extent of antibiotic-resistant *S. aureus* strains have relied on three factors: ensuring proper hand hygiene among healthcare workers, restricting the use of antibiotics, and promptly

identifying and isolates infected patients (Cooper *et al.*, 2004; Shahmoradi *et al.*, 2019).

According to reports collected from some targeted hospitals and laboratories, the percentage of *S. aureus* prevalence is the highest (41.3%) as seen in figure (1). This finding makes the study correspondent to that of a previous study (Rameshkannan *et al.*, 2014), which give percentage of (39%) *S. aureus*.

The percentage of *S. aureus* prevalence is (49.2%) in males, compared (50.8%) in females, as referred to in figures (2). This result differs from a previous study (Ayepola *et al.*, 2018), which revealed that (52.2%) in males, and (47.8%) in females.

Regarding the "age percentage" in the study, as referred to in figures (3), the age group (21-40) years is highest, with a percentage of (54.20%), whereas the age group (Over 61) years was the lowest, with a percentage of only (2.62%). This result makes the study inconsistent with that in another study carried out by (Onwubiko and Sadiq, 2011), which give percentage of (60%) the age group (Under 20) years, and (23.3%) the age group (21-40) years.

The distribution of *S. aureus* in the clinical samples was high in pus (31.51%), followed urine (28.15%), as shown in figure (4). By this result, the study has a resemblance to that in the previous study by (Amirmozafari *et al.*, 2019), which give percentage of 36% and 22.2 for pus and urine, respectively.

The figure (5) of the study, reflected the percentage of "sensitivity of *S. aureus*" was: sensitive (43.15%), moderate (24.53%) and resistance (32.32%), and this is what makes the study corresponding to the study of (Sebastian *et al.*, 2019) in the aspect of "sensitivity".

Table (2) of the our study, shown that Piperacillin, Levofloxacin, Doxycycline, Ciprofloxacin and Amikacin, respectively was

a highest proportion of sensitivity to *S. aureus*, and, this comes similar with the findings of a previous study carried out by (Chandrakar *et al.* 2016), regarding the proportion of sensitivity to *S. aureus*. However, most of the highly-sensitivity antibiotic were an inhibitor of bacterial protein synthesis and an interference with nucleic acid synthesis. Furthermore, with passing of time, may be reduced little by little until it vanishes at least (Dionisio *et al.*, 2005).

A higher sensitivity of Piperacillin was (89.66%), while the resistant was absent in the present study, this result is almost similar with previous study by (Sebastian *et al.*, 2019), whereas, the sensitivity in the previous study was (89.00%), while the resistant was (11.00%).

In our results, revealed that the lack resistant for Levofloxacin and high sensitivity 83.54%, in this study was similar with a previous study in Lahore (Romano and Alfonso, 2004), the resistant and sensitivity was 68.13%, 25.5% respectively.

The absolute resistant was represented by Ampicillin, and Cefdinir, and following by Amoxicillin and Lincomycin, this comes similar with the findings of previous study carried out by (Chandrakar *et al.*, 2016). Due to the misuse of antibiotics may result in the building up of antimicrobial-resistant bacteria. Uncontrolled selling of antibiotics may be another factor which contributed to the problem

because antibiotics were being sold in an open and unprotected environment with direct exposure to the sun. this may render the antimicrobials ineffective and, once used for the treatment, expose bacteria to suboptimal concentrations, thereby creating the conditions for the bacteria to develop resistance (**Massawe et al., 2019**).

The our study, showed the high percentage of resistant to Amoxicillin (76%). Whereas, the percentage of sensitivity was non-existent. The Amoxicillin-resistance agreed with a previous study by (**Ahmed et al., 2018**), and other study by (**Prasad et al., 2018**), which were 94%, 65.9%, respectively. Furthermore, the lack of antibiotic sensitivity in Thamar city-Yemen, due to unorganized prescription and over the counter handling of antibiotics.

Our study, showed in table (2), point out that, the 100% were Ampicillin-resistant, which agree with previous study in Brazil, at the same percentage by (**Canhas et al., 2017**). This higher resistance of *S. aureus* against penicillins may be attributed to the production of β -lactamase enzyme responsible for inactivation β -lactams which cannot bind to native PBP2A, so synthesis of peptidoglycan and bacterial growth occur normally (**Liu et al., 2017; Qayyum et al, 2016**). Our study revealed much higher percentage of Cefdinir-resistant than that reported by (**Canhas et al., 2017**), they found Cefdinir-resistant was 12.50%, which was much lower than our observations,

which represented by (100%) of Cefdinir-resistant.

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Conflict of interest:

No conflict of interest associated with this work.

Conclusions

The present study showed that *S. aureus*, was the most common bacteria in clinical specimens. *S. aureus* was most sensitivity to Piperacillin, Levofloxacin, Doxycycline, Ciprofloxacin, Amikacin, Ofloxacin, Gentamicin, Azithromycin, Lomefloxacin and Vancomycin. However, *S. aureus* reveled high resistant to Ampicillin, Cefdinir, Amoxicillin, Lincomycin, Ceftazidime and Erythromycin. Patients with *S. aureus* infection in females have higher rate of infection than that in males. The highest frequency of isolates of *S. aureus*, has accrued in the age group (21-40) years. This study observed a high antibiotic prescription rate by clinicians and that the treatment guidelines for management of patients were not followed. It is notable *S. aureus* was more present in the urinary system because it is more common in the urine sample.

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