Journal of Scientific Research in Medical and Biological Sciences

ISSN 2709-0159(print) and ISSN 2709-1511 (online)

Volume 5, Issue 3 Article 9

DOI: https://doi.org/10.47631/jsrmbs.v5i3.793

A STUDY INVOLVING BACTERIOLOGY ON SOME BACTERIA CONNECTED WITH RESPIRATORY TRACT INFECTIONS IN BAGHDAD CITY

Farah Ali Hameed

Department of Emergency medicine and first aids Techniques, Institute of Medical Technology, Middle Technical University, Baghdad, Iraq.

ARTICLE INFO

Recieved: 21 June 2024
Revised: 19 July 2024
Accepted: 27 Augt 2024

Keywords:
Respiratory tract, Diabetes, Helylysin, Capsule

Corresponding Author:

Farah Ali Hameed

Email:
farah_ali3@mtu.edu.iq

ABSTRACT

Seventy-five samples were collected from the respiratory tract areas, distributed among 25 people with respiratory tract infections and diabetes, 25 people with respiratory tract infections and without diabetes, and 25 people without diabetes as a control group. Collecting samples from May 9 to November 28, 2022, from patients visiting chest and respiratory diseases consultation clinics with and without diabetes in Baghdad city. The results showed that S. aureus were the most isolated, accounting for 42%, 50%, and 22% of people with respiratory tract infections and diabetes, people with respiratory tract infections, people without diabetes, and healthy people, respectively. As for the isolated species, their frequency ranged from S. epidermidis to 15% and 21%. 44%, respectively. Followed by S. pyogenes, the percentage reached 21%, 14%, and 22%, respectively. Followed by S. pneumonia at 10% and 7%, respectively. Finally, Viridans Streptococci Group was 10%, 7%, and 11%, respectively. The results of the study showed virulence factors associated with the pathogenicity of bacterial species. It was found that 12 (70) % of S. aureus were able to produce capsule, 8 (80) % belonged to S. epidermidis, 4 (50) %, 3 (75) %, and 2 (66.6) % belonged to To Staphylococcus aureus. S. epidermis. to S. pyogenes, S. pneumonia, and Viridans Streptococci group, respectively. A The results of the adhesion test showed that 15(88) %, 6(60) %, 5(62.5) %, 3(75) %, 2(66.6) % belonged to S. aureus, S. epidermidis, S. pyogenes, S. pneumonia, and Streptococci viridans, respectively. The results showed that the isolates were able to produce the enzyme helylysin and were 13 (76) %, 3 (37.5) %, 2 (50) %, and 3 (100) % for the same species, respectively.

INTRODUCTION

The respiratory system is the main link between the body and the external environment, as a person breathes atmospheric air, and it flows with the microscopic organisms present in it into the respiratory tract (1). Bacteria are one of those microbes that enter the respiratory tract. However, some of them exist naturally and live in it as part of the natural flora; some of them have an essential role in the occurrence of respiratory infections because they are opportunistic in cases of weak body resistance and many pathogens contribute to causing these infections in addition to bacteria, such as filters, viruses, which spread widely and to a lesser extent than fungi and parasites. Transmission of infection varies, some of which occur as a result of infection from infected people through droplets and the use of patients' items such as towels or through what is known as hospital infection, and chronic carriers are considered a source of transmission of the disease (2). Respiratory infections that affect humans target the upper and lower respiratory tract, and lower respiratory infections are the most dangerous because they infect the lungs, bronchi, and bronchi, causing complications that may have serious consequences when the disease condition of the infected person develops (3). World Health Organization reports indicate an increase in death rates annually. Especially in newborn children due to acute respiratory diseases, especially pneumonia disease, which has led to the death of three million children under the age of five in developed countries, which is caused by the bacteria *Streptococcus pneumoniae*. The number of deaths due to acute respiratory diseases rises to five million in low-income countries (4). Although the respiratory system has multiple mechanisms to protect it from infections, such as the hairs that line the nose, the presence of cilia on the surface of the epithelial layer surrounding it, the mucous material surrounding the nasal cavities and respiratory ducts, the presence of non-specific antibacterial substances such as lysozyme and interferon, and the quality of respiratory secretions. In addition to the humoral immune response represented by the work of lymphocytes and their formation of antibodies to germs and cellular activity represented by the activity of phagocytic cells (5), However, several factors increase the severity of the germ's infection of the host, which makes the germs capable of the host's primary defence lines and also contribute to the destruction of the tissue in which they inhabit, such as gender, weakness or frailty, obesity, malignant diseases, nerve diseases, and taking immunosuppressive medications, as well as These germs possess factors that increase the severity of their pathogenicity, directly or indirectly. These are known as virulence factors, such as capsule, pili, and flagella, which have a role in the germ's adhesion to the surfaces of the host's cells, It also produces many enzymes by destroying host tissues, such as the enzymes Hyaluronidase, Coagulase, Lipase, the toxin that kills white blood cells, pcidin Haemolysins, and others, which are of great importance in causing bacterial pathogenicity (6). Since their discovery, antibiotics have had a significant impact in reducing various infection rates. Still, the indiscriminate use of antibiotics in treatment has led to the emergence of bacterial strains resistant to one or more antibiotics, and this is considered a serious problem from a therapeutic standpoint (7). This study aimed to Isolating and diagnosing the bacteria that cause respiratory tract infections, knowing the sensitivity of bacteria to antibiotics, and studying some important virulence factors related to bacterial pathogenicity.

METHODOLOGY

Collecting samples

Seventy-five samples were collected in the period from 9, May 2022 to 28 November 2022 from patients visiting the chest and respiratory diseases consultation clinics with and without diabetes, and the samples were taken using a marked cotton swab from sputum and swabs from the nose, ears, tonsils and pharynx using sterile and direct cotton swabs. The test was performed in less than an hour.

Bacterial isolation and identification

Culture specimens

The samples were cultured on enriched media, blood agar and goblet culture, as well as the differential medium, MacConkey agar, to detect Gram-negative and positive bacteria. The dishes were incubated at a temperature of 37°C for 24 hours.

Identification of Bacteria

Diagnosis of bacterial species

A number of tests and examinations were performed to ensure the purity of the isolates, based on cultural phenotypic examinations, microscopic examinations, and biochemical examinations such as oxidase, catalase, and Imvic test, and the diagnosis was confirmed with the Vitic system.

Antibiotic resistance

Antibiotic susceptibility testing against respiratory and diagnosed isolates was performed according to the standard Kirby Bauer Disk method. Seven antibiotics were used according to the Bauer and Kirby method, as stated in (8).

Detection of Capsule production

As stated in (9). I used the harmful staining method. I mixed a small amount of bacterial growth taken from a 24-hour-old colony with a drop of necrocin dye spread on a slide by making a smear with a wooden stick on the edge of another glass slide. I left the slide to dry in the air and examined it under a microscope. The capsule appears as a white (non-pigmented) halo surrounding the bacterial cell if it is composed of bacteria.

Adhesion factors

The epithelial cell attachment method was used for this purpose, and oral epithelial cells were isolated based on what was reported (10) as follows: Epithelial cells were collected from Buccal Mucosa oral mucosa using a sterile cotton swab and placed in 5 ml of phosphate-buffered saline (PBS). The epithelial cells were washed three times using a centrifuge at a speed of 3000 rpm for 5 minutes. The sedimented cells were suspended with a PBS solution and used immediately to conduct an adhesion test. Then, 0.5 ml of a 24-hour-old bacterial culture was added to the same amount of epithelial cell suspension Epithelial cells were mixed by inverting the tube, then incubating at a temperature of 37°C for an hour and in a shaking incubator at a speed of 40 rpm/min. 3 The cells were centrifuged and washed four times with phosphate-salt buffer in order to eliminate bacteria not adhering to the epithelial cells. A small drop of the final suspension of epithelial cells was placed on a clean glass slide and allowed to dry at room temperature. Then, it was fixed by heat, stained with a Gram stain, and examined under an oil lens to observe the bacteria adhered to the epithelial cells.

Detection of B-Lactamase production:

The rapid political iodine method mentioned in (11) was used to investigate the production of the beta-lactamase enzyme. The process of work included preparing 24-hour-old bacterial cultures grown on a blood agar medium. Then a number of colonies were transferred using the loop to a Microtiter plate containing 100 microliters of Penicillin G and mixed well with the solution. Incubated for 30 minutes at 37°C. Then add 50 µL of starch solution and mix well with the contents of the hole. Finally, 20 microliters of iodine solution were added, as a dark blue colour was formed from the reaction of iodine with the starch. The result was considered positive when a rapid colour change occurred from dark blue to white less than a minute after adding the reagents. The test is repeated when a positive result appears more than 5 minutes late. The negative control experiment was conducted following the previous steps but without using bacterial colonies.

Haemolysin production test

The bacterial isolates to be tested for their ability to produce the hemolysin enzyme were grown on a blood agar medium and then incubated at 37°C for 24 hours. The appearance of a transparent area of decomposition under and around the colonies indicated a positive result of the test (12).

RESULTS AND DISCUSSION

Sample Collection

The results, as shown in Table (1), showed that the samples taken from different sites of the respiratory system of the people included in the study that showed bacterial growth were 76% for people with respiratory tract infections and diabetes, 56% for people with respiratory tract infections who did not have diabetes, and 36% for ordinary people. For the control group. The high incidence of infection in the first group may be due to diabetes, as (13) indicated that infections in general are more common in patients with diabetes, certain types of pneumonia, urinary and reproductive tract infections, and others. The increase in the rate of infections not only reflects a defect in the immune system but also many other causes that may play an important role, such as vascular dysfunction, nerve dysfunction, and chemically abnormal internal surroundings. In general, many points of disturbance in the activities of the immune system have been observed. For example, in white blood cells with nuclei, a lack of attraction to inflammatory cells was observed, and a defect in phagocytosis and killing of germs inside the cells was observed. The reason for all of these points may be due to the limited amount of energy available to the cells due to the lack of insulin. Complement may also be affected in diabetics. Perhaps the reason is due to the high amount of glucose in the blood serum, which may lead to the addition of a glucose molecule enzymatically to the third or fourth complement molecule. C4 and C3 (13). We also notice in Table (1) the appearance of bacterial growth among members of the control group, and this was confirmed by (14) that the upper respiratory tract contains bacterial species that are considered normal flora, most of which are Streptococcus species alpha, gamma, and M. catarrhalis, in addition to the presence of pathogenic bacteria H influenza and pneumonia, which are common in the region, especially during the cold seasons of the year. He also pointed out that the spread of bacteria in the upper respiratory tract has an apparent effect on infections of the lower respiratory tract in cases of immune weakness (15).

Table 1. Rates of respiratory tract infections among people included in the study

Cases covered By studying	**NO**	**Samples with bacterial growth (number)**	**%**	**Samples that do not contain growth Bacterial (number)**	**%**
People with infections Respiratory tract and diabetes	25	19	76	6	2.4
People with infections Respiratory tracts and more People with diabetes	25	14	56	11	4.4
control	25	9	36	16	64

Diagnosis Of Bacterial Isolates

The bacteria were diagnosed based on the phenotypic characteristics and biochemical tests reported by (16) (9). The diagnosis was confirmed using the Vitic system for members of the Enterobacteriaceae family and Gram-negative bacteria. API Staph for diagnosing the subspecies Staphylococcus, as 42 bacterial isolates were diagnosed, distributed among 8 (42% belong to the bacteria *Staphylococcus aureus*, 3 isolates (15%) belong to the bacteria *Staphylococcus epidermidis*, 4 (21)% belong to *S. pyogenes*, 2 (10)% belong to *S. pneumoniae*, and 2 (10)% belong to Viridans Streptococci from samples of people with respiratory tract infections and diabetes. As for the number of bacterial isolates isolated from people with respiratory tract infections Those who did not have diabetes. The total number of isolates was 14 bacterial isolates, distributed among 7 (50)% belonging to *S. aureus*, 3 (21%) belonging to *S. epidermidis*, 2 (14)% belonging to *S. pyogenes*, 1 (7)% belonging to *S. pneumoniae*, and 1(7)% belong to *Viridans Streptococci*.

While 9 isolates from the genes of healthy people (control group) were identified, they were divided into 2 (22)% belonging to the bacterium *S. aureus*, 4 isolates (44%) belonging to the bacterium *S. epidermidis*, 2 (22)% belonging to *S. pyogenes*, and 1 (11)% belonging to *Streptococci Viridans*.

Table 2. Types of bacteria and their percentages isolated from respiratory tract infections of people included in the study

Cases covered By studying	Total number of isolates	Staphylococcus aureus		Staphylococcus epidermidis		S. pyogenes		S. pneumoniae		Viridans Streptococci group	
		No	%	No	%	No	%	no	%	no	%
People with infections Respiratory tract And with diabetes	19	8	42	3	21	4	21	2	10	2	10
People with infections Respiratory tracts and more People with diabetes	14	7	50	3	21	2	14	1	7	1	7
control	9	2	22	4	44	2	22	-	-	1	11

Table (2) shows that Staph areas bacteria are the most abundant among the isolated bacterial types, as they amounted to 17 isolates distributed among 8 (42) %, 7 (50) %, and 2 (22) % for the three groups included in the study: people with diabetes, people without diabetes. Diabetes and healthy people are a control group, respectively, and this is similar to many studies, as (17) indicated *S. aureus* constituted the highest infection rate, 11.2%, among the bacterial causes of upper respiratory infections. (18) also indicated that this bacterium is the most widespread of the group of Gram-positive bacteria that cause various respiratory infections, including pneumonia and bronchitis. In a study conducted in Taiwan, it was indicated (19) that the rate of infection with this bacterium reached (53-83). In contrast, it was reported (20) that the rate of infection with respiratory infections caused by *S. aureus* constituted a small percentage, not exceeding 9%. The reason for the significant presence of these bacteria in respiratory tract infections may be due to their possession of many virulence factors, some of which are located in the cell wall consisting of glycopeptides such as protein A, teichoic acid, and capsular, Some toxins and enzymes decompose complex substances such as proteins and fats, as these factors enable them to adhere to the cells lining the respiratory canal, penetrate the body's tissues, and also resist the process of phagocytosis, in addition to the coexistence of these bacteria naturally on the respiratory passages, mucous membranes, and skin (21).

While the bacteria *S. epidermidis* came in second place, the infection rate reached 3 (15)%, 3 (21)%, and 4 (44)%, respectively, among the bacterial causes of respiratory tract infections in the people included in the study, people without diabetes and people Healthy control group and straight. These results were an approach to what was found (22), as the percentage of infection with *S. epidermidis* was among the bacterial causes of respiratory diseases, and studies indicate its importance in respiratory infections because it is considered a natural flora, but sometimes it may lead to disease, especially in people who complain of weakness in the body's defence mechanism, especially in the stage of maturity or old age (23). The results did not agree with the findings of (24) regarding the incidence of respiratory infections resulting from pneumonia bacteria. k is estimated at (19%), (25) pointed out that this bacterium is one of the natural, transient flora found on the human body, and in addition to its scavenger existence in the nasopharynx and intestinal tract, it represents one of the types of opportunistic pathogens as it accompanies elderly patients, those who suffer from weak immune systems, alcoholics, diabetics, and other patients. Chronic pulmonary insufficiency is one of the bacteria that causes increasing complications in AIDS patients. (26) also pointed out that this bacteria possess a number of virulence factors that are involved in its pathogenesis, including capsular antigens and adhesion factors represented by cilia, and the production of endotoxins such as lipopolysaccharide, as well as resistance to influence Killer for serum and iron acquisition system. *S. pyogenes* and Viridans Streptococci ranked third, with the infection rate reaching 4 (21) %, 2 (14) %, and 2 (22) %, respectively, for *S. pyogenes* bacteria, which are among the bacterial causes of respiratory tract infections in the people included in the study. People without diabetes, people with diabetes, and healthy people were the control group, respectively. The isolation rates of Viridans Streptococci were 2 (10)%, 1 (7)%, and 1 (11)%, respectively, for people without diabetes, people with diabetes, and healthy people, the control group. Our results were similar to the findings of (27), who found that these two types constituted an infection rate of 7.1% and 7.1%, respectively. In contrast, the results were lower than those found by (28), who found that the S. *pyogenes* bacteria were among patients with respiratory tract infections. The results were also consistent with (28) who isolated the *S. pyogenes* bacterium (17%) from patients with respiratory infections. Many studies have shown that the bacteria rarely infect the respiratory system in ordinary people, but their prevalence increases in patients with Chronic diseases and patients taking immunosuppressive medicatim, (30) also pointed out that these bacteria are among the most dangerous opportunistic pathogens because they possess many virulence factors such as enzymes and toxins, which have a high ability to adhere to the mucous membranes of respiratory epithelial tissues and have few nutritional requirements in addition to possessing many antibiotic resistance mechanisms.

And bacteria *S. pneumoniae* came in last place, constituting 2(10) % and 1(7) %. The subjects included in the study were distributed as follows: people with diabetes and people without diabetes. As (31) pointed out, the use of immunosuppressive drugs and antibiotics for various diseases may lead to an increase in opportunistic *S. pneumoniae* infections caused by the Enterobacteriaceae family, among which it is noted from the results above that there is a difference in the rates of infection with bacterial causes and their numbers among the people included in the study. An increase in the rates of bacteria causing opportunistic respiratory tract infections has also been observed in people with diabetes compared to people without diabetes. The reason for this is due to the increased susceptibility of the host to infections as a result of reduced lymphocyte activity and neutrophil dysfunction, with failure to attract inflammatory cells and dysfunction chemotaxis. These results were similar to what he found, indicating that there were some differences in the proportions of pathogens isolated from people with and without diabetes, as the percentage of *S. pneumoniae* doubled to 99.2% isolated from people with diabetes. In comparison, it reached 41.2% among people without diabetes, and this is what was recorded in our study. These results were consistent with the findings of (32), who found that all isolates belonging to Streptomyces bacteria contained the capsule. The results are also consistent with what was reported by (32), who confirmed that predatory strains contain amphipods in the capsule, (33) indicated that Streptomyces contain a capsule of hyaluronic acid, which plays a significant role in the bacteria's resistance to the phagocytosis process. The results were inconsistent with (34), which found that 37% of its *S. aureus* isolates contained the capsule. Meanwhile, (34) indicated that most of the strains of *S. aureus* contain the outer wall of a mucous layer called a capsule or polysaccharide, which enables these bacteria to resist the process of phagocytosis. As confirmed (35) Staph. The epidermis produces a substance that most strains produce, a slime substance (gel) composed of polysaccharides that help them avoid the defences of the host present in the capsule.

Detection of Virulence factors

capsule production

The results shown in Table (3) showed that 29 isolates contained the capsule out of a total of 42 isolates, as 12 (70) % of them were *S. aureus* and 8(80%) for Staph bacteria. the epidermis, while *S. pyogenes* bacteria showed 4 (50) %, while 2 isolates (22.7%) were from *Viridans Streptococci* group bacteria.

These results were consistent with the findings of (36), who found that all isolates belonging to *S. pyogenes* and other species of Streptococcus contain the capsule. As (37) indicated, the possession of *S. pyogenes*. S on a hyaluronic acid capsule, and pneumonia S. on a polysaccharide capsule, which plays a significant role in the bacteria's resistance to the phagocytosis process, while the results were not consistent with (38), which found that 37% of its isolates belonging to *S. aureus*. Container on wallet, while (39) indicated that most of the strains of *S. aureus* contain the outer wall of a mucous layer called a capsule or polysaccharide, which enables these bacteria to resist the process of phagocytosis. (40) also confirmed that most *S. epidermidis* strains produced a Goldman and Green slime (gel) composed of polysaccharides that helped them evade the host's defences.

Table 3. Percentages of some factors associated with the pathogenicity of the bacteria under study

no	**Bacterial isolates**	**no**	**Capsule production Number %&**	**adhesion With cells Epithelial Number and%**	**Hemolysine production Number&%**	**Enzyme production β Number & %**
1	Staphylococcus aureus	17	12(70%)	15(88%)	13 (%76)	5(29%)
2	Staphylococcus epidermidis	10	8 (80)%	6 (60%)	-	6(60%)
3	S. pyogenes	8	4 (50) %	5(62.5%)	3(37.5%)	4 (50) %
4	S. pneumoniae	4	3 (75) %	3(75%)	2(50%)	3 (75) %
5	Streptococci Viridans group	3	2(66.6)%	2(66.6%)	3(100%)	1(33) %

Detection Adhesion Factors in Bacteria

The ability of the bacterial isolates under study to adhere to the epithelial cells lining the mouth was investigated. The results showed a difference in the percentages of adhesion to epithelial cells between the bacterial species in Table (3). It was found that *S. aureus* had an 88% ability to adhere to epithelial cells. While the isolates of *S. pneumoniae* bacteria showed the ability of *S. pneumoniae* bacteria to adhere to epithelial cells at a rate of 75%, these results were close to the findings of (41), which found that *S. pneumoniae* showed the ability to adhere to epithelial cells at a rate of 72%. (42) pointed out that Gram-positive bacteria are characterized by the fact that their adhesive factors are represented by polysaccharide adhesions, from which the cell wall and capsule are composed. Teichoic acid, which is considered one of the components of the wall in Gram-positive bacteria, also acts as an adhesive agent. Ali, as confirmed (43), that the *S. pneumoniae* bacterium possesses many virulence factors that contribute to its pathogenicity, such as the capsule and the M protein, which helps in confronting the bacteria for the phagocytosis process and works to facilitate the adhesion and colonization of the bacteria to the upper respiratory system, Meanwhile, (44) indicated the presence of *S. pneumoniae* and *S. aureus* fibronectin-binding proteins are believed to be receptors for fibronectin, which is a complex, high-molecular-weight glycoprotein compound found in various body fluids, plasma, and the surfaces of cells lining the mouth.

Haemolysin Production Test

The results in Table (3) showed that 18 isolates had a positive outcome for haemolysis production. It was distributed among 13 (76)% *S. aureus* bacteria, 3 (37.5)% *S. pyogenes* bacteria, 3 (37.5)% and *S. pneumoniae* gave 2 (50)% positive test results. In contrast, isolates of group Viridans Streptococci bacteria were observed to produce hemolysin at a rate of 100%. This study was identical to the findings of (45), who found that all *S. pneumoniae*, S. *pyogenes*, and Viridans Streptococci hemolyzed the blood by 37% and 74%. At the same time, no isolate of the *S. epidermidis* bacteria gave any positive result for the hemolysin production test. The results regarding his isolates of *S. aureus* bacteria were 42% producing the hemolysin enzyme, meaning a positive outcome for testing hemolysin production. The results were also contrary to the findings of (46) that two isolates of *S. epidermidis* bacteria. It has shown the ability to produce the hemolytic enzyme Haemolysin.

Production Of Beta-Lactamase Enzymes

From observing Table (3), we find that 26 isolates showed a positive test result out of 42 bacterial isolates, distributed among 12 (70.5)% of the *S. aureus* isolates and 6 (60)% of the *S. epidermidis* isolates showed a positive test result, and 4 (50) showed a positive result for the test. % of *S.*

pyogenes bacteria were capable of producing beta-lactamase enzymes. As for *S. pneumoniae* bacteria, 3 (75)% of them were positive for beta-lactamase enzymes, while 1 (33)% of the *Viridans Streptococci* group bacteria produced them. These results were similar to the findings of (47), who found that their isolates belonging to *S. epidermidis* bacteria could produce beta-lactamase enzymes at a rate of 71%. At the same time, we agree with them regarding their isolates belonging to *S. aureus*, which produced beta-lactamase enzymes at a rate of 71%. Also, the results of this study were not consistent with what (48) stated, as each of the *S. aureus* produced beta-lactamase enzymes at a rate of 14.1%.

Antibiotic Sensitivity Test

Table 4 shows the percentages of resistance to Gram-positive bacterial isolates isolated from respiratory tract infections in the people included in the study. The results showed that the bacteria *S. pyogenes* and *S. pneumoniae* showed complete resistance to the antibiotic Apmicillin, and these results were identical to what was found here. (49) Its isolates belonging to *S. pyogenes* were utterly resistant to this antibiotic, as shown by (50) that the resistance rate of *S. pyogenes* bacteria to this antibiotic was 100%, while the resistance rate of its isolates belonging to *S. pneumoniae* was, As for the antibiotics of the Aminoglycosides group, which included the antibiotics Amikacin and Streptomycin, their resistance rates were 5 (29)% and 100%, respectively. We note that there is a difference in the antibiotics of this group in terms of their effect on the isolates under study, while our study did not agree with what we found. (51) We found that its isolates were 45.5% resistant to Streptomycin. The results also showed that our isolates showed weak resistance to Amikacin for both *S.pyogenes* , *S. epidermidis*, *S. pyogenes*, and *S. pneumoniae*, and they were 29%, 20%, 25%, 25%, and 33.3%, respectively. While the *Viridans Streptococci* group showed complete sensitivity to this antibiotic This is close to what was found by (52) since the isolates belong to *S. aureus*, which was 100% resistant to this antibiotic, while its isolates showed *S. epidermidis* is completely sensitive to this antibiotic. These antibodies inhibit protein synthesis inside the cell because of their ability to bind to the small subunit of the ribosome (305), leading to a misreading of the mRNA codes, which results in the production of unnecessary proteins that have a fatal effect on the bacterial cell (53).

Resistance to anti-aminoglycosides has been increasing significantly in recent paragraphs. This resistance is the result of the production of enzymes by resistant bacteria that modify the drug and thus lose its effectiveness, or it comes as a result of the loss of some outer membrane proteins, which is said to be the permeability of the antibiotic into the cell. Bacteria can also resist these. The group of antibodies occurs through a change in the subunit of the ribosomal 308 to which the antigen binds. This change leads to a reduction in the affinity of the antigen to it and thus to resistance of the bacterial cell (54). Referring to Table (4), it is clear that the isolates from this study showed feeble resistance to the Quinolones group antibiotics represented by Ciprofloxacin, as the resistance rate reached *S. aureus* and *S. pyogenes* by referring to Table (4), it is clear that the isolates from this study showed feeble resistance to the Quinolones group antibiotics represented by Ciprofloxacin. The resistance rate of *S. aureus* and S pyogenes bacteria was 7.41% and 112.5%, respectively. While *S. epidermidis*, *K. pneumonia*, and *Viridans Streptococci* bacteria showed complete sensitivity to this antibiotic. This result was consistent with the findings of (55), which showed that *S. aureus* and *S. pyogenes* showed weak resistance to this antibiotic, amounting to 9.9% and 20%, respectively. While the results of our study did not agree with the findings, she resisted her isolation due to the *S. aureus*, this antibiotic is Ciprofloxacin at a rate of 16%, which resisted the isolation of the *S. aureus* this antibiotic by 16%. The reason for the sensitivity of bacteria to this antibiotic may be attributed to the fact that the isolates did not develop high resistance to this antibiotic due to its limited use in the country and because it is a broad-spectrum antibiotic (56). This antibiotic also works to inhibit the action of the DNA gyrase enzyme, which is responsible for uncoiling the DNA helix and ensures their separation during the process of DNA cloning and on *S. pneumoniae* and *S. epidermis*, respectively, while both Streptococci and Viridans bacteria showed complete sensitivity to this antibiotic (56).

Gram-positive bacteria resist quinolone antibiotics by changing the target of the antigen, DNA gyrase or Topoisomerase IV, depending on the structure of the quinolone, which is the most common mechanism, as a number of studies have proven that mutations lead to changes in the composition of the antigen's binding site, its charge, or both. This affects the binding of quinolone to the enzyme DNA gyrase, and mutations in the genes encoding the enzyme Topoisomerase IV lead to resistance to quinolone, as in *S. aureus* bacteria (57). As for the antibiotic Chloramphenicol, the isolates under study showed weak resistance to it at rates of 29%, 3.75%, 25%, and 25%, distributed among *Staphylococcus aureus Staphylococcus epidermidis*, *S. pyogenes*, and *K. pneumonia*, respectively. While the bacteria of the Viridans Streptococci group showed complete sensitivity, these results were close to what was found by (58) in terms of the weak resistance shown by his isolates, as their resistance rate to this antibiotic reached 25%. In contrast, *S. epidermidis* showed complete sensitivity to this antibiotic. It was contrary to the findings of (59), which found that both *S. epidermis* and *S. pyogenes* bacteria showed high resistance to this antibiotic, 76.2%, 93.3%, and 100%, respectively.

It is noted from the results of this study that there was a significant decrease in the resistance of the isolates under study to the antibiotic Chloramphenicol. This may be due to the scarcity of use of this antibiotic in treating respiratory tract infections and other infections in view of the side complications, as the resistance rate decreased from 33.8% in (60) to 13.33% in (61). The results of this study showed that the isolates under study were resistant to the antibiotic Rifampicin, as it was found that the rate of resistance to each of the bacteria *S. pneumoniae* and *S. pyogenes*, *S. epidermidis*, *S. aureus*, *Viridans* and *Streptococci* reached 58.8%, 70%, 25%, 75% and 33.3%, respectively. The results of this study were not consistent with (58), as the resistance rate of their isolates to this antibiotic reached 80% and 71%, respectively. The method of resistance to anti-rifampicin is through chromosomal mutations that lead to changes in the target site of the DNA-dependent RNA polymerase, which causes the inability of anti-rifampicin to bind to this enzyme, as in staphylococcal bacteria (62). The results showed that the rate of resistance to the macrolide antibiotics represented by Erythromycin is 29%, 90%, 16.6%, 75%, and 66.6% for each of *S. pneumoniae* and *S. pyogenes S. epidermidis, S. aureus* and *Streptococci viridans*, respectively. These results are not consistent with the findings of (63), where the rate of resistance to pyogenes and *S. aureus* 75% and 40%, respectively, while the results were inconsistent with what (64) found that it was 86% and 33% *S. epidermidis* and *S. aureus* and, respectively, to Erythromycin. Resistance to this group of antibiotics occurs by changing the target site of the antigen binding to the ribosome, which leads to reduced binding of the antigen. Resistance can also be mediated by the production of enzymes that work to esterify the antibiotic, such as the erythromycin esterase enzyme (65).

Table 4. Percentages of resistance of isolated types of respiratory tract infections to some antibiotics

Bacterial isolates	N0	Amikacin(%)	Streptomycin (%)	Erythromycin(%)	Ciprofloxacin(%)	Chloramphenicol(%)	Rifampicin(%)	Ampicillin (%)
Staphylococcus aureus	17	5(29%)	6(35%)	5(29%)	7(41%)	5(29%)	10(58.8%)	12(70.5%)
Staphylococcus epidermidis	10	2(20%)	9(90%)	9(90%)	0	3(75%)	7(70%)	8(80%)
S. pyogenes	8	2(25%)	6(75%)	1(16.6%)	1(12.5)%	5(25%)	2(25%)	8(100%)
S. pneumoniae	4	1(25%)	1(25%)	3(75%)	0	1(25%)	3(75%)	4(100%)
Viridans Streptococci group	3	1(33.3%)	2(66%)	2(66.6%)	0	0	1(33.3%)	2(66.6%)

CONCLUSION

The results of our study showed that the most common types of respiratory infections were the bacterial species Staphylococcus aureus, Staphylococcus epidermidis S. pyogenes S. pneumoniae and Viridans Streptococci group. S. aureus was the most isolated in this study. Diabetes mellitus has a role in increasing the incidence of respiratory infections. Bacterial isolates possess many virulence factors that enhance their ability to cause pathogenicity, including the production of hemolysin, the production of the beta-lactamase enzyme, and their possession of a preservative and the ability to adhere to the epithelial cells lining the respiratory infections. They have shown multiple resistance to the antibiotics used.

REFERENCES

Abbas R, Chakkour M, Zein El Dine H, Obaseki EF, Obeid ST, Jezzini A, et al. General Overview of Klebsiella pneumonia: Epidemiology and the Role of Siderophores in Its Pathogenicity. Biology. 2024;13(2):78.

Akarsu H, Liljander AM, Lacasta A, Ssajjakambwe P, Brodard I, Cherbuin JD, et al. Canine Staphylococcaceae circulating in a Kenyan animal shelter. Microbiology spectrum. 2024;12(2):e02924-23.

Alexander SK, Strete D, Niles MJ. Laboratory exercises in organismal and molecular microbiology: McGraw-Hill; 2004.

ALI F. Isolation and Identification of Oral Bacteria and Characterization for biofilm formation and antibiotics resistance. Wasit Journal for Pure sciences. 2024;3(1):106-15.

Ali S, Assafi M. Prevalence and antibiogram of Pseudomonas aeruginosa and Staphylococcus aureus clinical isolates from burns and wounds in Duhok City, Iraq. The Journal of Infection in Developing Countries. 2024;18(01):82-92.

Altwiley D. Defining Capsule Production by Staphylococcus Aureus and the Role it Plays in Patient Outcome: University of Bristol; 2023.

Arjun R, Niyas VKM, Hussain F, Surendran S, Mohan V. Clinical and microbiological profile of Viridans group streptococcal bacteraemia; experience from South India. Le Infezioni in Medicina. 2024;32(1):37.

Arroyo-Urea EM, Lázaro-Díez M, Garmendia J, Herranz F, González-Paredes A. Lipid-based nanomedicines for the treatment of bacterial respiratory infections: current state and new perspectives. Nanomedicine. 2024;19(4):325-43.

Atlas R. Principle of microbiology 1st ed. Mosby–year bock Inc. 1995.

Azam A, Basharat A, Shahid R, Mannan T, Awais H, Bashir F. Abasyn Journal of Life Sciences.

Benson HJ. Microbiological applications: a laboratory manual in general microbiology: [McGraw-Hill]; 2002.

Bhagchandani T, Nikita, Verma A, Tandon R. Exploring the human Virome: composition, dynamics, and implications for health and disease. Current Microbiology. 2024;81(1):16.

Bhattacharya M, Horswill AR. The role of human extracellular matrix proteins in defining Staphylococcus aureus biofilm infections. FEMS Microbiology Reviews. 2024:fuae002.

Bradford PA. Extended-spectrum β-lactamases in the 21st century: characterization, epidemiology, and detection of this important resistance threat. Clinical microbiology reviews. 2001;14(4):933-51.

Breijyeh Z, Karaman R. Design and synthesis of novel antimicrobial agents. Antibiotics. 2023;12(3):628.

Bush A, Byrnes CA, Chan KC, Chang AB, Ferreira JC, Holden KA, et al. Social determinants of respiratory health from birth: still of concern in the 21st century? European Respiratory Review. 2024;33(172).

Chauhan RS, Malik YS, Saminathan M, Tripathi BN. Immunopathology of Pneumonia in Animals. Essentials of Veterinary Immunology and Immunopathology: Springer; 2024. p. 169-215.

Cinar MS, Niyas A, Avci FY. Serine-rich repeat proteins: well-known yet little-understood bacterial adhesins. Journal of Bacteriology. 2024;206(1):e00241-23.

Cunnington AJ, Abbara A, Bawa FK, Achan J. Identification and management of co-infections in people with malaria. bmj. 2024;384.

da Silveira Ferreira IC, de Paula Menezes R, de Jesus TA, Lopes MSM, de Araújo LB, Ferreira DMdLM, et al. Unraveling the Epidemiology of Urinary Tract Infections in Neonates: Perspective from a Brazilian NICU. American Journal of Infection Control. 2024.

Darwitz BP, Genito CJ, Thurlow LR. Triple threat: how diabetes results in worsened bacterial infections. Infection and Immunity. 2024:e00509-23.

Debnath N, Goswami A, Modi S. PHENOTYPIC DETECTION OF METALLO-β-LACTAMASE PRODUCTION IN ACINETOBACTER BAUMANNII ISOLATED FROM VARIOUS CLINICAL SPECIMENS. International Journal of Medicine and Public Health. 2024;14(1):420-5.

El-Aziz A, El Sheikh S, Galal A, Refky Y. Possible Alternative Strategies to Combat Antimicrobial Resistance. Zagazig Veterinary Journal. 2024;52(1):1-24.

Fang Y, Lei Z, Zhang L, Liu CH, Chai Q. Regulatory functions and mechanisms of human microbiota in infectious diseases. hLife. 2024.

Gao S, Jin W, Quan Y, Li Y, Shen Y, Yuan S, et al. Bacterial capsules: Occurrence, mechanism, and function. npj Biofilms and Microbiomes. 2024;10(1):1-15.

Getie M, Gebre-Selassie S, Getu Y, Birara S, Tiruneh C, Abebaw A, et al. Bacterial profile and extended spectrum beta lactamase screening of urinary tract infection among asymptomatic and symptomatic pregnant women attending antenatal care in ALERT Hospital, Addis Ababa, Ethiopia. SAGE Open Medicine. 2023;11:20503121231197587.

Guo X, Wang L, Zhang J, Liu Q, Wang B, Liu D, et al. Thwarting resistance: MgrA inhibition with methylophiopogonanone a unveils a new battlefront against S. aureus. npj Biofilms and Microbiomes. 2024;10(1):15.

He P, Wang D, Zheng R, Wang H, Fu L, Tang G, et al. An antibacterial biologic patch based on bacterial cellulose for repair of infected hernias. Carbohydrate Polymers. 2024:121942.

Hindler JF, Munro S. Antimicrobial susceptibility testing. Clinical microbiology procedures handbook. 2010:5.0. 1-5.18. 2.1.

Hussein EF. Detection and Antibiotic Susceptibility Patterns of Staphylococcus aureus, Streptococcus pyogenes and Streptococcus spp. Isolated from Sputum of Patients with Respiratory Tract Infections. Journal of Communicable Diseases (E-ISSN: 2581-351X & P-ISSN: 0019-5138). 2024;56(1):50-6.

Irenge CA, Bikioli F, Mulashe PB, Kasali FM, Wimba P, Lwango A, et al. Profile of Multidrug Resistant Bacteria in Bukavu Hospitals and Antimicrobial Susceptibility to Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis and Staphylococcus aureus. Advances in Microbiology. 2024;14(04):209-25.

Iwahi T, Abe Y, Nakao M, Imada A, Tsuchiya K. Role of type 1 fimbriae in the pathogenesis of ascending urinary tract infection induced by Escherichia coli in mice. Infection and Immunity. 1983;39(3):1307-15.

Jafar ZN, Athbi AM. Biosynthesis of Silver Nanoparticles Using Ethanolic Extract of the Marine Alga Enteromorpha intestinalis and Evaluation of their Antibacterial Activity. Egyptian Journal of Aquatic Biology and Fisheries. 2024;28(2):735-56.

Jena D, Srivastava N, Yasir M, Dan D. Intranasal Delivery of Lipid Nanoparticles: A Ground-breaking Approach for Brain Targeting. Current Nanomaterials. 2024;9(3):209-23.

Ji X, Guo J, Ma Y, Zhang S, Yang Z, Li Y, et al. Quercetin alleviates the toxicity of difenoconazole to the respiratory system of carp by reducing ROS accumulation and maintaining mitochondrial dynamic balance. Toxicology and Applied Pharmacology. 2024 116860.

Juda EK, Khalaf KJ. Effect of Some Metals Ions on Hemolysin Production from Clinical Isolates of Escherichia coli. Journal of Contemporary Medical Sciences. 2024;10(1).

Kassab MM. Development of lipid nanoparticles (LNP)-RNA vaccine against Streptococcus pneumoniae gene cluster facilitating the synthesis of the capsular polysaccharide in Egypt. International Journal of Health Sciences (Egypt). 2024;2(1):35-49.

Khan R, Gowri S. Antimicrobial Dressings: The Wound Care Applications: Elsevier; 2023.

La Corte C, Catania V, Dara M, Parrinello D, Staropoli M, Trapani MR, et al. Equinins as Novel Broad-Spectrum Antimicrobial Peptides Isolated from the Cnidarian Actinia equina (Linnaeus, 1758). Marine Drugs. 2024;22(4):172.

Lathakumari RH, Vajravelu LK, Satheesan A, Ravi S, Thulukanam J. Antibiotics and the gut microbiome: Understanding the impact on human health. Medicine in Microecology. 2024:100106.

Lim J-S, Chai Y-Y, Ser W-X, Van Haeren A, Lim Y-H, Raja T, et al. Novel drug candidates against antibiotic-resistant microorganisms: A review. Iranian journal of basic medical sciences. 2024;27(2):134.

Ma Y, Chang X, Zhang S, Zhang P, Guo T, Zhang X, et al. New broad-spectrum and potent antibacterial agents with dual-targeting mechanism: Promoting FtsZ polymerization and disrupting bacterial membranes. European Journal of Medicinal Chemistry. 2024;263:115930.

Marrella V, Nicchiotti F, Cassani B. Microbiota and Immunity during Respiratory Infections: Lung and Gut Affair. International Journal of Molecular Sciences. 2024;25(7):4051.

Montoya-Giraldo M, Piper KR, Ikhimiukor OO, Park CJ, Caimi NA, Buecher DC, et al. Ecology shapes the genomic and biosynthetic diversification of Streptomyces bacteria from insectivorous bats. Microbial Genomics. 2024;10(4):001238.

Nickel KB, Durkin MJ, Olsen MA, Sahrmann JM, Neuner E, O'Neil CA, et al. Utilization of broad- versus narrow-spectrum antibiotics for the treatment of outpatient community-acquired pneumonia among adults in the United States. Pharmacoepidemiology and drug safety. 2024;33(4):e5779.

Oliveira MWMd, Prado JCS, Silva MSd, Martins MGdQ, Barbosa FCB. Frequency of Multidrug-Resistant Microorganisms Associated with Bacterial Coinfections in Hospitalized Patient with Covid-19: A Literature Review. Archives of Current Research International. 2024;24(3):27-37.

Paul J. Respiratory Tract Infections. Disease Causing Microbes: Springer; 2024. p. 99-148.

Rajha H, Alsheikh R, Zar A, Mohsen S, Zughaier SM. Microbiology and Antimicrobial Resistance in Diabetic Foot Infections. 2024.

Rizwan M, Usman K, Alsafran M. Ecological Impacts and Potential Hazards of Nickel on Soil Microbes, Plants, and Human Health. Chemosphere. 2024:142028.

Royal SS, Sigma SH, Ashraf MN, Rimi SS, Affroze S, Yousup S, et al. Isolation and Molecular Detection of Antibiotic Resistant Staphylococcus aureus from Pet Birds of Mymensigh City Corporation Areas, Bangladesh. American Journal of Microbiological Research. 2024;12(1):1-6.

Salle R, Del Giudice P, Skayem C, Hua C, Chosidow O. Secondary Bacterial Infections in Patients with Atopic Dermatitis or Other Common Dermatoses. American Journal of Clinical Dermatology. 2024:1-15.

Sanford TC, Tweten RK, Abrahamsen HL. Bacterial cholesterol-dependent cytolysins and their interaction with the human immune response. Current Opinion in Infectious Diseases. 2024:10.1097.

Sato'o Y. Staphylococcus aureus Pathogenesis Based on Genetic Background. Staphylococcus aureus: Interplay between Bacteria and Hosts. 2024:119-50.

Seidel RW, Goddard R, Lang M, Richter A. Nα-aroyl-N-aryl-phenylalanine amides: a promising class of antimycobacterial agents targeting the RNA polymerase. Chemistry & Biodiversity. 2024:e202400267.

Shabeera P, Mounika V, Rasheed S, Rahin AS, Hemanth B. Pneumonia And Types & An Over View On Aspiration Pneumonia. International Journal of Pharmaceutical Sciences. 2024;2(01):1-.

Shannon BA, Hurst JR, Flannagan RS, Craig HC, Rishi A, Kasper KJ, et al. Streptolysin S is required for Streptococcus pyogenes nasopharyngeal and skin infection in HLA-transgenic mice. PLoS pathogens. 2024;20(3):e1012072.

Sheykhsaran E, Abbasi A, Memar MY, Ghotaslou R, Baghi HB, Mazraeh FN, et al. The role of Staphylococcus aureus in Cystic Fibrosis Pathogenesis and Clinico-Microbiological Interactions. Diagnostic Microbiology and Infectious Disease. 2024:116294.

Shizukuishi S, Ogawa M, Kuroda E, Hamaguchi S, Sakuma C, Kakuta S, et al. Pneumococcal sialidase promotes bacterial survival by fine-tuning of pneumolysin-mediated membrane disruption. Cell Reports. 2024;43(3).

Su MS-W, Cheng Y-L, Lin Y-S, Wu J-J. Interplay between group A Streptococcus and host innate immune responses. Microbiology and Molecular Biology Reviews. 2024;88(1):e00052-22.

Taj Z, Chattopadhyay I. Staphylococcus aureus Virulence Factors and Biofilm Components: Synthesis, Structure, Function and Inhibitors. ESKAPE Pathogens: Detection, Mechanisms and Treatment Strategies: Springer; 2024. p. 227-70.

Tebano G, Zaghi I, Baldasso F, Calgarini C, Capozzi R, Salvadori C, et al. Antibiotic Resistance to Molecules Commonly Prescribed for the Treatment of Antibiotic-Resistant Gram-Positive Pathogens: What Is Relevant for the Clinician? Pathogens. 2024;13(1):88.

Tran BC, Nguyen VLP, Truong TT, Nguyen TK. Prevalence and Antimicrobial Susceptibility of Escherichia coli Isolated from Goats in the Mekong Delta, Vietnam. World.14(1):129-36.

Wu R, Nahm M, Yang J, Bush CA, Wu H. Identification and genetic engineering of pneumococcal capsule-like polysaccharides in commensal oral streptococci. Microbiology Spectrum. 2024;12(4):e01885-23.

Xia L, Li Y, Wang Y, Zhou H, Dandekar AA, Xu F, et al. Quorum-sensing regulation of phenazine production heightens Pseudomonas aeruginosa resistance to ciprofloxacin. Antimicrobial Agents and Chemotherapy. 2024:e00118-24.

Zafer MM, Mohamed GA, Ibrahim SR, Ghosh S, Bornman C, Elfaky MA. Biofilm-mediated infections by multidrug-resistant microbes: a comprehensive exploration and forward perspectives. Archives of Microbiology. 2024;206(3):101.