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Original Research Article

Antibiotic Resistance Patterns in Bacterial Conjunctivitis

Ali Abd Kadhum[1*]

[1]Department of Community Health Techniques, Al-Nasiriyah Technical Institute, Southern Technical University, Thi-Qar Province, Iraq

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***Corresponding author:** Ali Abd Kadhum
Department of Community Health Techniques, Al-Nasiriyah Technical Institute, Southern Technical University, Thi-Qar Province, Iraq

Abstract

Background: The conjunctivitis, known generally as pink eyes, is the inflammation of the inner eyelids, as well as the entire surface of the eye´s outermost part, which makes it get a reddish-pink look. The symptoms may involve pain, burning and itching, most often when an allergic cause is implicated. ***Method:*** The present work considered 306 scenarios of human blepharitis, cultured swabs were plated on MacConkey agar and Blood agar used streak technique and incubated at 37°C in a 24-hour experiment. Bacterial isolates were pointed based on their appearance, gram-staining, direct microscopy and biochemical tests comprising of catalase, oxidase, mannitol fermentation and hemolysis. Enterosystem 18 R system and the Vitek-2 compact system were used for the confirmation of bacterial species. Microplate method was used to test for biofilm formation of the bacterial isolates. ***Results:*** Antibiotic resistance test of isolates, however, reflected relatively high resistance among them, with *Staphylococcus aureus, Pseudomonas aeruginosa, Streptococcus pneumoniae, Moraxella catarrhalis and Klebsiellapneumoniae* all being 100% resistant to amoxicillin. *Klebsiella pneumonia* and *E. coli* isolates showed a 90% resistance to moxifloxacin, and to ciprofloxacin by *Staphylococcus* aureus isolates. *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus vulgaris*, and *Streptococcus pneumoniae* exhibited significant biofilm production, whereas the other isolated species showed lower biofilm-forming tendencies.

Keywords: Inflammation, Antibiotic resistance, Biofilm-forming, Amoxicillin.

INTRODUCTION

The most prevalent ocular affliction known as pink eye or conjunctivitis is a prototypical conjunctival inflammation process, which involves the irritation of the conjunctiva, a thin membrane adjacent to the eye surface. The source of conjunctivitis can be varied ranging from allergies as well as viruses and bacteria, however, this paper takes a specific focus on bacterial etiology that has contributed on as common as bacterial strains and their pattern of antibiotic resistance [1]. Through learning those microbe ecology, it will be easier to have a good clinical management or traditional health strategies [2]. This infection usually takes place in the initial phase of growth and or increasing of the population of the pathogen on the conjunctival surface [3]. Among the most powerful bacterial offenders includes the *Staphylococcus aureus, Streptococcus pneumoniae, Haemophilusinfluenzae and Moraxellacatarrhalis*. Pathogens use the characteristic like lowered defense mechanism, ocular injury and much more to lead the infection [4]. It should be now revealed that the specific types of bacteria most often present may differ regionally and by ethnic groups [5]. It indicates the need to adopt regional epidemiological studies for such investigation [6]. Concurrently, the development of antibiotic resistance among bacterial conjunctivitis isolates prevails to be a momentous hindrance in response [7]. The over- and misuses of antibiotics have been a main locomotive for the appearance of the resistant strains; therefore, will require stricter monitoring and more sense in the way we use these antibiotics [8, 9]. Comprehension of resistant behaviors is the foundation not only of selecting a proper baseline regimen but also for an antibiotic step-down strategy in order to minimize therapeutic failures [10]. Eye infections in the Clinically external can be presented as conjunctivitis, keratitis, blepharitis, canaliculitis, dacryocystitis, external hordeolum and cellulitis. The disease symptoms of inflammation of the eyes along with absses that caused by bacteria in the world. The Gram-positive bacteria are cause purulent bacterial conjunctivitis is mainly [11]. Pathogenic bacteria causing eye infections through microorganism and host virulence factors increase resistance. There are several different and varying factors, such as living conditions, weak social immunity, chemical treatments, and chronic diseases. Pathogenic bacteria can be considered a major factor contributing to eye infections worldwide. The World Health Organization (WHO) has recognized that eye infections are among the main causes of visual impairment, blindness or loss of vision in all countries of the world [12].

MATERIALS AND METHODS

The interaction between bacterial causes and antibiotic resistance was studied in order to elucidate a dynamic description of conjunctivitis cases. The clinical specimens, mainly conjunctival swabs were collected from the patients that presented with symptoms conjunctivitis at the Al-Haboubi Hospital between October 2022 and December 2023. Inclusion criteria: The patients (306 cases) had similar clinical symptoms of chronic bacterial conjunctivitis including eye discharge, injection of conjuctional cavity and redness and swelling of eye lids. The mid-eye-swab was split between Macconkey's agar and blood agar streaks and kept at 37°C for 24 hours of incubations. Colony appearances, Gram staining, direct microscopy and some of the biochemical laboratory tests such as catalase, oxidase, mannitol fermentation and hemolysis were used to identify bacteria isolates along with conformational tests such as Enterosystem 18 R and Vitek-2 compact systems. Antibacterial susceptibility tests were carried out in the Kirby-Bauer disc diffusion method and Vitek-2 compact system, which is consistent with Clinical and Laboratory Standards Institute (CLSI) references. Different antibiotics such as penicillins, fluoroquinolones, aminoglycosides and macrolides - which are often prescribed for eye infections - have also been tested for their effectiveness against some ocular bacteria. For biofilm formation all isolates were activated using heart and brain infusion broth (BHIB) and left for 24 hours in an incubator at a temperature of 37°C, then a micro-plate method was used to detect the ability of bacteria to form biofilm [13]. A statistical examination was done using SPSS 2016 software and Excel 2016 workbook to establish the proportion of bacterial species as well the antibiotic- resistant ones. Such descriptive statistics were used to sum up demographic elements, microbiological isolates, and degrees of resistance. On the other hand, hotspots and trends of bacterial prevalence and resistance regarding space and time were analyzed to reveal potential dangers and to provide evidence for the implementation of targeting measures towards these reasons.

RESULTS

The study consisted of 306 patients, 166 males and 140 females with criteria of conjunctivitis. The patients ranged in age from 2 to 79 years of age categorized into four age groups as shown in table (1).

Table (1): Distribution of the patients according to gender and age group

Age groups	Female	%	Male	%	Total	Grand %
2-21	102	60.71	66	39.29	168	54.90
22-41	28	36.36	49	63.64	77	25.16
42-61	8	16.67	40	83.33	48	15.69
62-81	2	15.38	11	84.62	13	4.25
Grand total	140		166		306	100

$X^2(df=3, N=306) = 39.08, p<0.001$

The majority of the patients were belonging to the age group of 2-21 years old accounting for 54.9% of the total study population. Also a highly significant difference were shown between the genders in different age groups.

The majority of isolated bacteria were *Escherichia coli* 70 isolates, *Proteus vulgaris* 58 isolates, *Staphylococcus epidermidis* 46 isolates and *Staphylococcus aureus* 34 isolates accounting for 23%, 19% ,15% and 11% of the total isolates respectively figure (1).

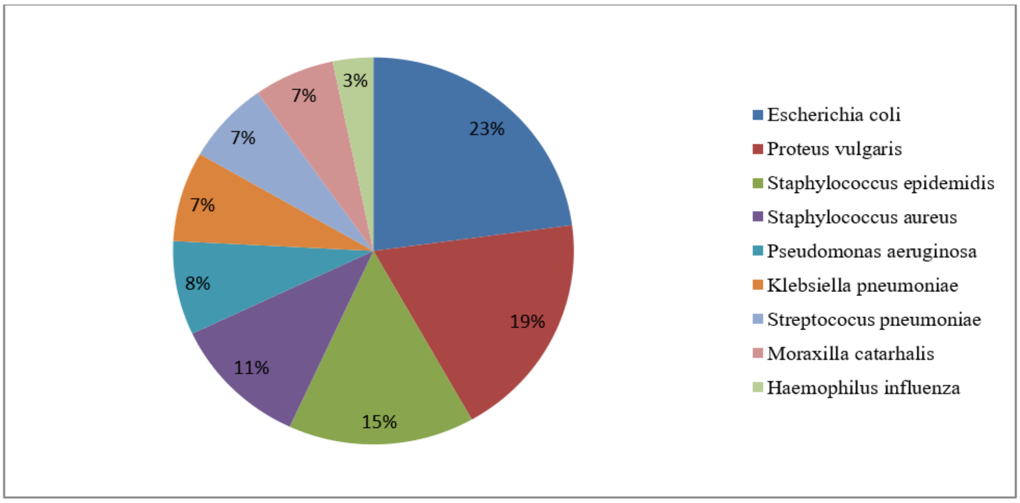

Figure (1): Bacterial species in respect to the total isolates

The majority of the bacterial isolates showed a significant resistance to different kind of antibiotics figure (2 to 6) shows the different antibiotic resistance pattern according to the bacterial isolates.

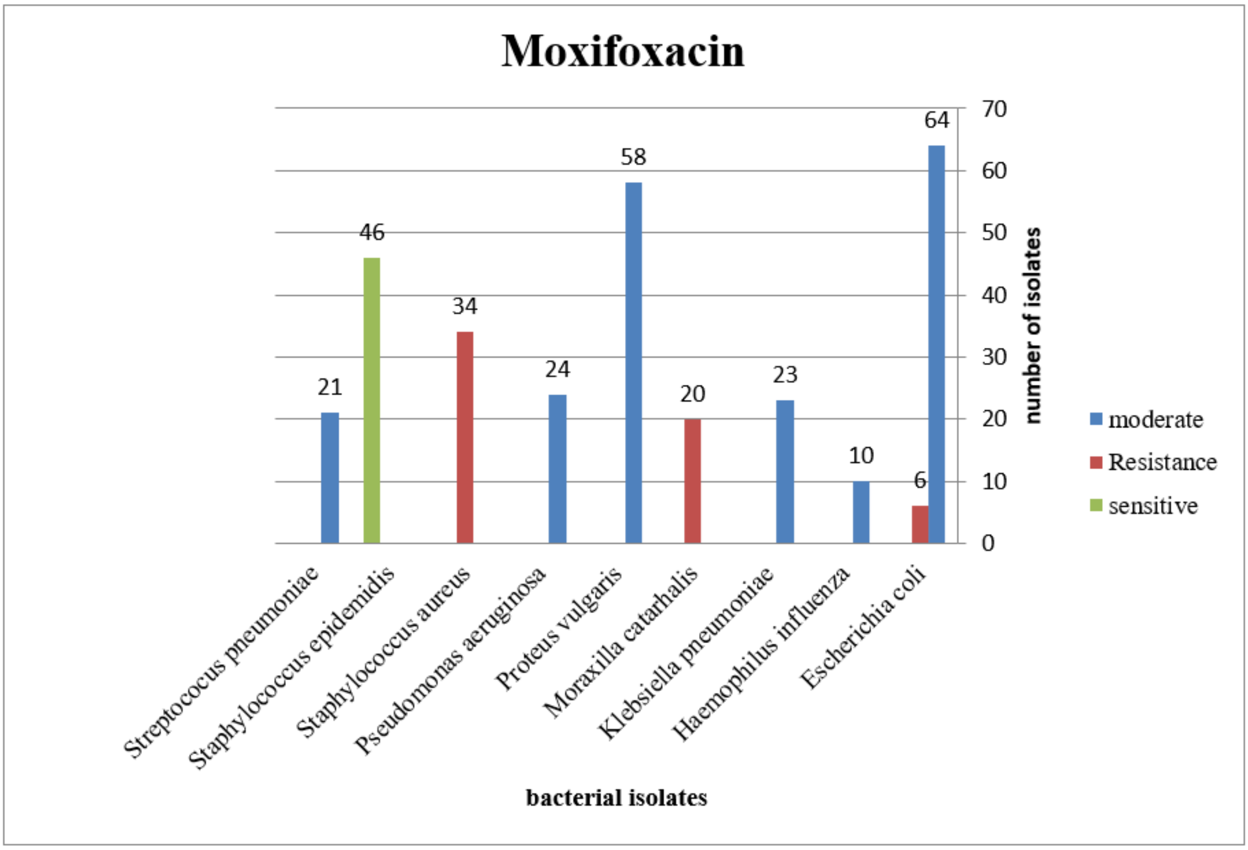

Figure (2): Resistance pattern to Moxifloxacin

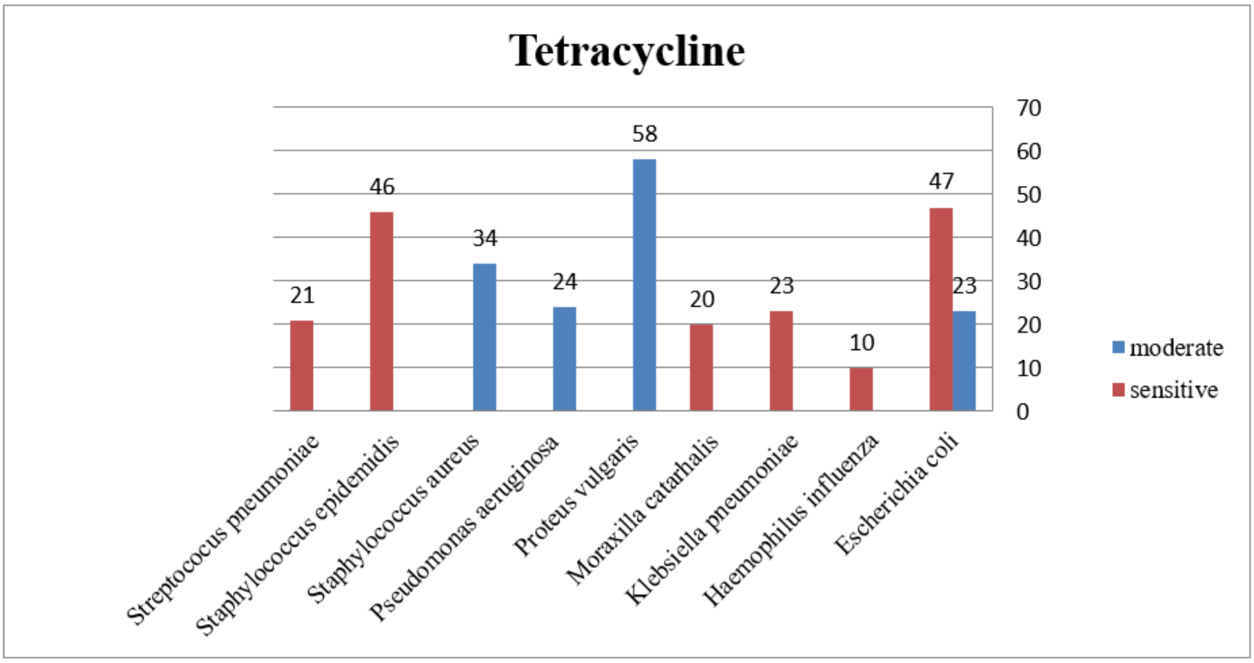

Figure (3): Resistance pattern to Tetracycline

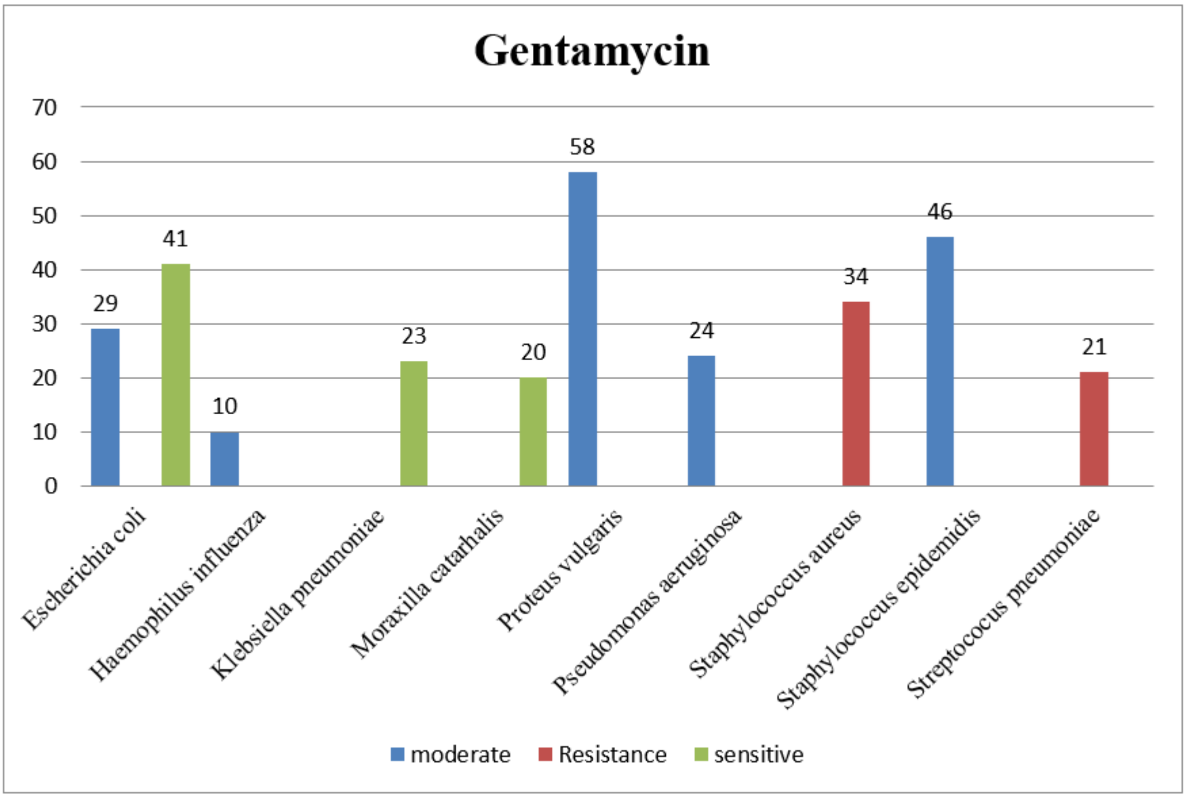

Figure (4): Resistance pattern to Gentamycin

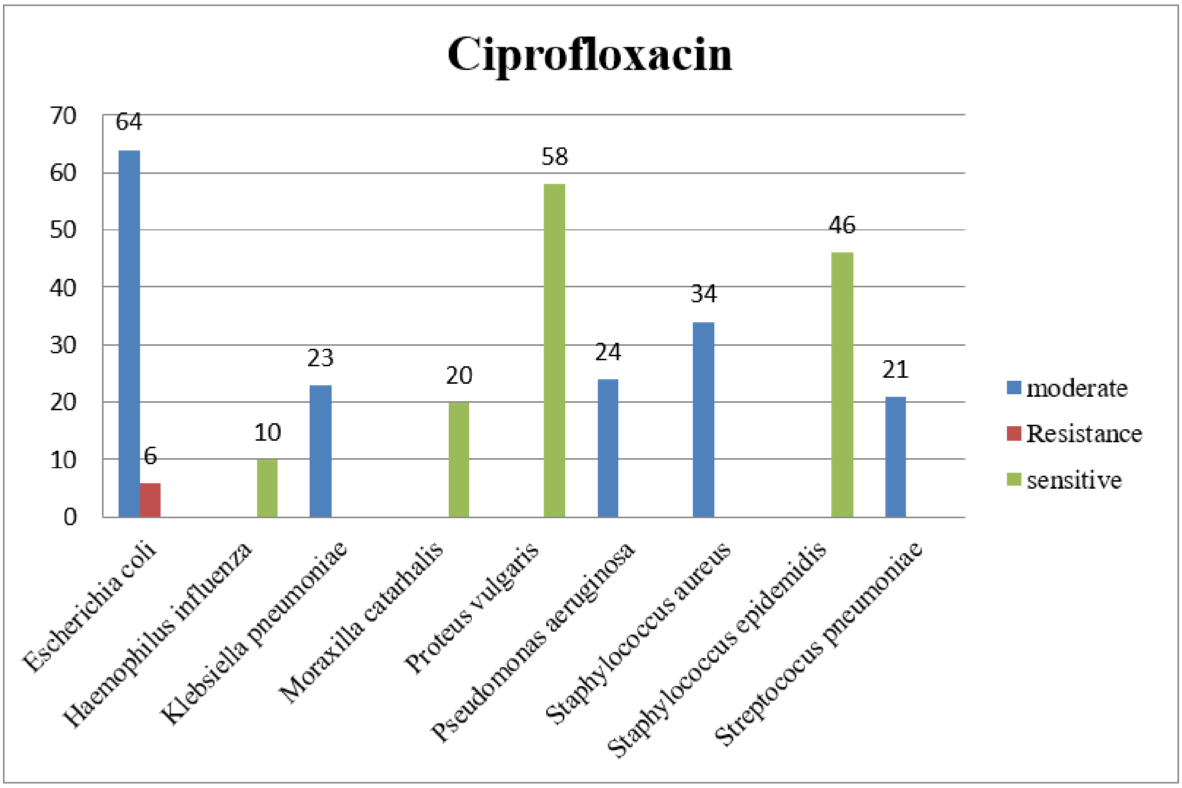

Figure (5): Resistance pattern to Ciprofloxacin

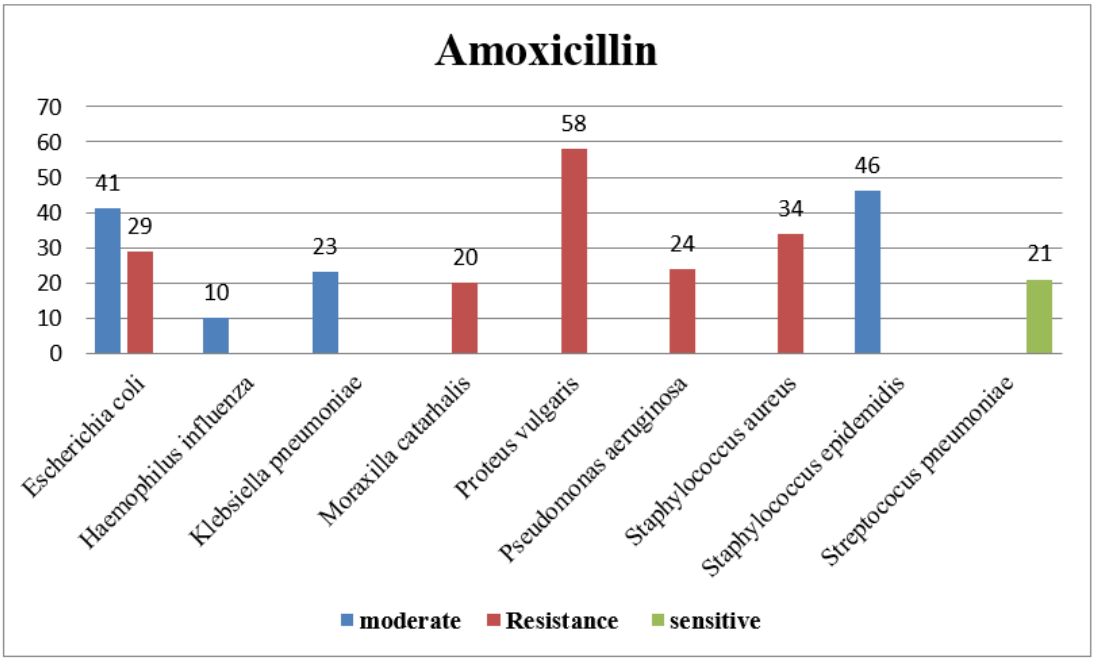

Figure (6): resistance pattern to Amoxicillin

The study also showed that 39.55% of the isolates have a tendency to form a biofilm niche as presented with Table (2).

Table (2): Bacterial isolates according to biofilm formation

Isolates	No. of isolates	Biofilm producer	%	Non-biofilm producer	%
Escherichia coli	70	10	14.28	60	85.71
Proteus vulgaris	58	38	65.51	20	34.48
Staphylococcus epidermidis	46	6	13.04	40	86.95
Staphylococcus aureus	34	5	14.70	29	85.29
Pseudomonas aeruginosa	24	23	95.83	1	4.16
Klebsiella pneumoniae	23	22	95.65	1	4.34
Streptococcus pneumoniae	21	9	42.85	12	57.14
Moraxella catarrhalis	20	2	10	18	90
Haemophilus influenzae	10	6	60	4	40
Total	306	121	39.54	185	60.45

$X^2(df=8, N=306)=54.68$, $p<0.01$

Pseudomonas aeruginosa and *klebsiella pneumonia* showed the highest tendencies to produce a biofilm accounting for 95.83% and 95.65 % respectively of their own respective species. Followed by *Proteus vulgaris* that also showed a significant biofilm formation with 65.51 % of all *Proteus vulgaris* isolates have the ability to produce a biofilm. On the other hand only 10% of *Moraxella catarhalis* showed a biofilm formation.

DISCUSSION

The study found that Age groups of 2-21 years and young people are the most frequent conjunctivitis infection, which is consistent with other research Agha, N. F. S. (2020) [14], and Ahmed *et al.*, (2022) [15]. Age groups of 62-81 yearsshowed the results 4.25 % and this result less compared with result mentioned by Mirzayev *et al.*, (2022) [15]. The current study found all *E.coli* isolates were most prevalent the present results are in near with some studies published by Al-Asadi *et al.*, (2023) [16] in Basrah. was staphylococcus aureus 15% and heamophiluss influenza 3% in this study but was differ from the result reported by Math & Rauth (2019) [17]. In this study a high percentage for Staphylococcus aureus resistance producing for Moxifloxacin, Gentamycin and Amoxicillin and this results are in line with some studies Al-Asadi *et al.*, (2023) [16] in basrah and Al-makhzoomy, (2018) [18] in kufa. *E.coli* and proteusvolgaris isolates were moderate pattern for Ciprofloxacillin. gentamycin and amoxicillin and this results are near with some results reported by Alshamahi, *et al.*, (2020) [19]. Bacterial conjunctivitis can be seen more commonly among the old and the male in comparison with the acute infective conjunctivitis which is often found among this particular set of demographic. While the viral conjunctivitis is more prevalent in the case of adults, the bacterial form of the infection is more severe among pediatrics patients with acute infective conjunctivitis [20]. Resistance of bacterial conjunctivitis causing pathogens towards different age groups is not consistency and may differ. Such as, children younger than 5 years old are easily infected with *Streptococcus pneumoniae*, *Haemophilusinfluenzae*, and *Staphylococcus aureus*, meanwhile, the elderly have a significant increase of MRSA related infection, and *S aureus* and *Pseudomonaaeruginosa* as the common infectious pathogens [21]. Similarly, current antibiotic resistance trends demonstrate that staphylococci by extension MRSA, have high resistance to oxacillin and azithromycin and often show multidrug resistance to a wide range of antimicrobials. In this way, it is the emergency medicine providers who treat the most often this. Problem this one. However, over the eight-year study period in the US, there was a small decline of resistance with the antimicrobial agents like azithromycin, ciprofloxacin, and oxacillin in *Staphylococcus aureus*, *P.aquinous* and CoNS, as a result, the prevalence of Ciprofloxacin in latter two serious disease [22]. The ability of the bacteria isolates to form a biofilm has been associated with antibiotics resistance as shown with Pseudomonas aeruginosa and Klebsiella pneuminae which show an substantial ability to produce biofilm and have a wide range of antibiotic resistant patterns this results are in agreement with [23, 24]. *Proteus vulgaris* also showed a substantial biofilm formation and antibiotic resistance profile which in line with the results obtained by Kwiecinska-Pirog *et al.*, (2016) [25]. Only 10 % of *Moraxella catarrhalis* were able to produce a biofilm which is much lower than what reported by Kanaan *et al.*, (2024) [26] , who showed that 52% of all *Moraxella catarrhalis* were biofilm producer this could be pivoted around the total sample size as in our study only 20 samples of *Moraxella catarrhalis* was isolated . The biofilm provide a shelter from the assaults of the immune system and limit the accessibility of the antibiotics to the niche, hence shows a great deal of resistance.

CONCLUSION

These findings propose that these bacterial isolates come with distinct virulence factors, that is, adhesions, toxins, and biofilm formation, that facilitate their ability to penetrate and infect conjunctival tissues. Furthermore, biofilm formation by species like *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* give both resistance to the host immune system and as well to antibiotics.

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