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Virulence factors in *Pseudomonas aeruginosa:* The arms race between bacteria and humans

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Pseudomonas aeruginosa (*P. aeruginosa*) is a Gram-negative, motile bacillus that can grow at 42°C as well as 37°C in aerobic circumstances. It also tests positive for oxidase and catalase enzymes [1-2]. The bacteria may be found in a variety of habitats, including water and soil [3,4]. It is also considered an opportunistic human pathogen which has the capacity to causes infection especially in individuals with immunocompromised system [5,6] and also can be present in hospital climate [7,8].

Pseudomonas aeruginosa has a number of virulence factors that play a role in pathogenesis in the host, including type IV pili, which are found near the cell pole [9] and flagella [10,11]. It also releases exopolysaccharide alginate [12], which is utilized to build biofilm [13]. Lipases and phospholipases, which target lipids in the surfactant and host cell membranes, are further pathogenic agents of the bacteria [14]. As well as exoenzymes S, T, U, and Y [15]. *Pseudomonas aeruginosa* also produces extracellular virulence factors such as elastase, toxin A, rhamnolipids, lipopolysaccharide (LPS), and protease [16]. These factors may be shared by other pathogens and may contribute directly or indirectly in resistance to multiple antibacterial agents [17-21].

Pseudomonas aeruginosa has a potential to develop biofilms on the surface of urinary catheters in addition to elaborating virulence factors. As a result, the most significant pathogenic characteristic of *P. aeruginosa* is the development of biofilms [22], which allows this bacterium to cause recurrent and chronic UTIs by evading host immune defense systems also biofilms contribute to the drug resistance and facilitate bacterial spreading.

Another virulence factor produced by *P. aeruginosa* is pyocyanin (PCN), a blue water-soluble pigment [23]. *Pseudomonas aeruginosa* may also produce pigments such as yellow-green, fluorescent pigments (pyoverdin), reddish pigment (pyorubin), and dark brown pigment (pyomelanin).

Pseudomonas aeruginosa may grow anaerobically and does not ferment, instead receive energy from sugar oxidation. This low nutritional requirement allows it to thrive in harsh environments like hospital operating rooms, hospital rooms, clinics, and medical equipment, as well as sinks, showers, and even contaminated distilled water [24], and has thus been identified as a significant source of nosocomial infection [25-28].

In conclusions: *Pseudomonas aeruginosa* has the ability to secret several virulence factors that can use in their pathogenicity leading to invade and

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damage cells as well as high rate of antibiotic resistance. More knowledge regarding these virulence factors is crucial to develop new strategies against growing challenges make by this bacterium. *P. aeruginosa* is an important infection in all populations, and it has been linked to an increase in morbidity and death among patients. The arms race between *P. aeruginosa* and humans is continuous and very long way that requires more efforts and researches.

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References

1-**Gellatly SL, Hancock REW.** *Pseudomonas aeruginosa*: new insights into pathogenesis and host defenses. Pathogens and Disease 2013;67: 159–173.

2-**Hameed AM, Malla S, Kumar RS.** Molecular characterization of *Pseudomonas sp.* isolated from milk samples by using RAPD-PCR. European Journal of Experimental Biology 2014 4:78-84.

3-**AL-Khikani FH.** The forgotten role of methenamine to prevent recurrent urinary tract infection: urgency for reuse 100 years after discovery. Pharmaceutical and Biomedical Research 2020; 5:24-32

4-**AL-Khikani FH, Kadim BJ, Ayit AS, Abidalali MH**. Evaluation cephalosporins resistance in pathogenic bacteria isolated clinically. World News of Natural Sciences 2020; 31:255-259

5-**AL-Khikani FH, Almosawey HS.** Be conscious to be healthy: An initiative to prevent recurrent urinary tract infection in Iraqi women. Hamdan Med J 2020; 12:44-6.

6-**AL-Khikani FH, Ayit AS.** Correlation study between urinary tract bacterial infection and some acute inflammatory responses. Biomedical and Biotechnology Research Journal (BBRJ) 2019; 3:236.

7-**Bavasheh N, Karmostaj A.** Antibiotic resistance pattern and evaluation of *blaOXA-10*, *blaPER-1*, *blaVEB*, *blaSHV* genes in isolates of *Pseudomonas aeruginosa* isolated from hospital in South of Iran in 2014-2015. Infect Epidemiol Med 2017;3: 1-5.

8-**Al-Khikani FH, Kadem BJ.** Unusual false-negative serum human chorionic gonadotropin detected by qualitative immunoassay: a case report of two Iraqi women. Journal of Medicine in Scientific Research 2020; 3:238.

9-**Persat A, Inclan YF, Engel JN, Stone HA, Gitai Z.** Type IV pili mechanochemically regulate virulence factors in *Pseudomonas aeruginosa*. Proceedings of the National Academy of Sciences of the United States of America 2015; 112:7563-7568.

10-**Veesenmeyer JL, Hauser AR, Lisboa T, Rello J.** *Pseudomonas aeruginosa* virulence and therapy: evolving translational strategies. Critical Care Medicine 37:1777-1786.

11-**AL-Khikani FH, Ayit AS.** Major challenges in dermatophytosis treatment: current options and future visions. Egyptian Journal of Dermatology and Venerology 2021; 41:1.

12-**Wozniak DJ, Wyckoff TJ, Starkey M, Keyser R, Azadi P, O'Toole GA, et al.** Alginate is not a significant component of the extracellular polysaccharide matrix of PA14 and PAO1 *Pseudomonas aeruginosa* biofilms. Proceedings of the National Academy of Sciences of the United States of America 2013; 100:7907-7912.

13-**Colvin KM, Irie Y, Tart CS, Urbano R, Whitney JC, Ryder C, et al.** The pel and psl polysaccharides provide *Pseudomonas aeruginosa* structural redundancy within the biofilm matrix 2012; 14: 1913-1928.

14-**Kuan EC, Tajudeen BA, Welch KC, Chandra RK, Glasgow BJ, Suh JD.** Aggressive necrotizing pseudomonal sinonasal infections. International Forum Allergy and Rhinology 2017; 7:910-915.

15- **Galle M, Jin S, Bogaert P, Haegman M, Vandenabeel P, Beyaert R.** The *Pseudomonas aeruginosa* type III secretion system has an exotoxin s/t/y independent during acute lung infection. PLoS One 2012; 7: e41547:1-8.

16-**Andrejko M, Zdybicka- Barabas A, Janczarek M, Cytrynska M.** Three *Pseudomonas aeruginosa* strains with different protease profile. Acta Biochemical Polonica 2013; 60:83–90.

17-**AL-Khikani FH.** Pulmonary mycoses treated by topical amphotericin B. Biomedical and Biotechnology Research Journal (BBRJ) 2020; 4:123.

18-**Al-Khikani FH.** Amphotericin B as antiviral drug: Possible efficacy against COVID-19. Annals of Thoracic Medicine 2020; 15:118.

19-**Almosawey HA, AL-Khikani FH, Hameed RM, Abdullah YJ, Al-Ibraheemi MK, Al-Asadi AA.** Tamoxifen from chemotherapy to antiviral drug: Possible activity against COVID-19. Biomed Biotechnol Res J 2020; 4:1-9.

20-**Falah AK, Hameed R.** COVID-19 treatment: Possible role of itraconazole as new therapeutic option. International Journal of Health & Allied Sciences 2020; 9:101-105.

21-**AL-Khikani FH.** Challenges in fungal treatment: A serious public health problem. Indian Journal of Medical Specialities 2020; 11:171.

22-**Mittal R, Aggarwal S, Sharma S, Chhibber S, Harjai K.** Urinary tract infections caused by *Pseudomonas aeruginosa*: a minireview. Journal of infection and public health 2009; 2:101-11.

23-**Mathew A, Eldo AN, Molly AG.** Production optimization, characterization and antimicrobial activity of pyocyanin from *Pseudomonas aeruginosa* SPC B 65. Biotechnology an Indian Journal 2011; 5:297-301.

24- **Abreu PMD, Farias PD, Paiva GS, Almeida AM, Vasconcelos P.** Persistence of microbial communities including Pseudomonas aeruginosa in a hospital environment: a potential health hazard. BMC Microbiol 2017; 10:317 e328.

25-**AL-Khikani FH, Abadi RM, Ayit AS.** Emerging carbapenemase Klebsiella oxytoca with multidrug resistance implicated in urinary tract infection. Biomedical and Biotechnology Research Journal (BBRJ) 2020; 4:148.

26-**AL-Khikani FH.** Trends in antibiotic resistance of major uropathogens. Matrix Science Medica 2020; 4:108.

27-**Al-Khikani FH, Almosawey HA, Abdullah YJ, Al-Asadi AA, Hameed RM, Hasan NF, et al.** Potential antiviral properties of antifungal drugs. Journal of the Egyptian Women's Dermatologic Society 2020; 17:185.

28-**AL-Khikani FH.** Antimicrobial resistance profile among major bacterial pathogens in Southern Babil, Iraq. Galician medical journal 2020;27: E202036-.