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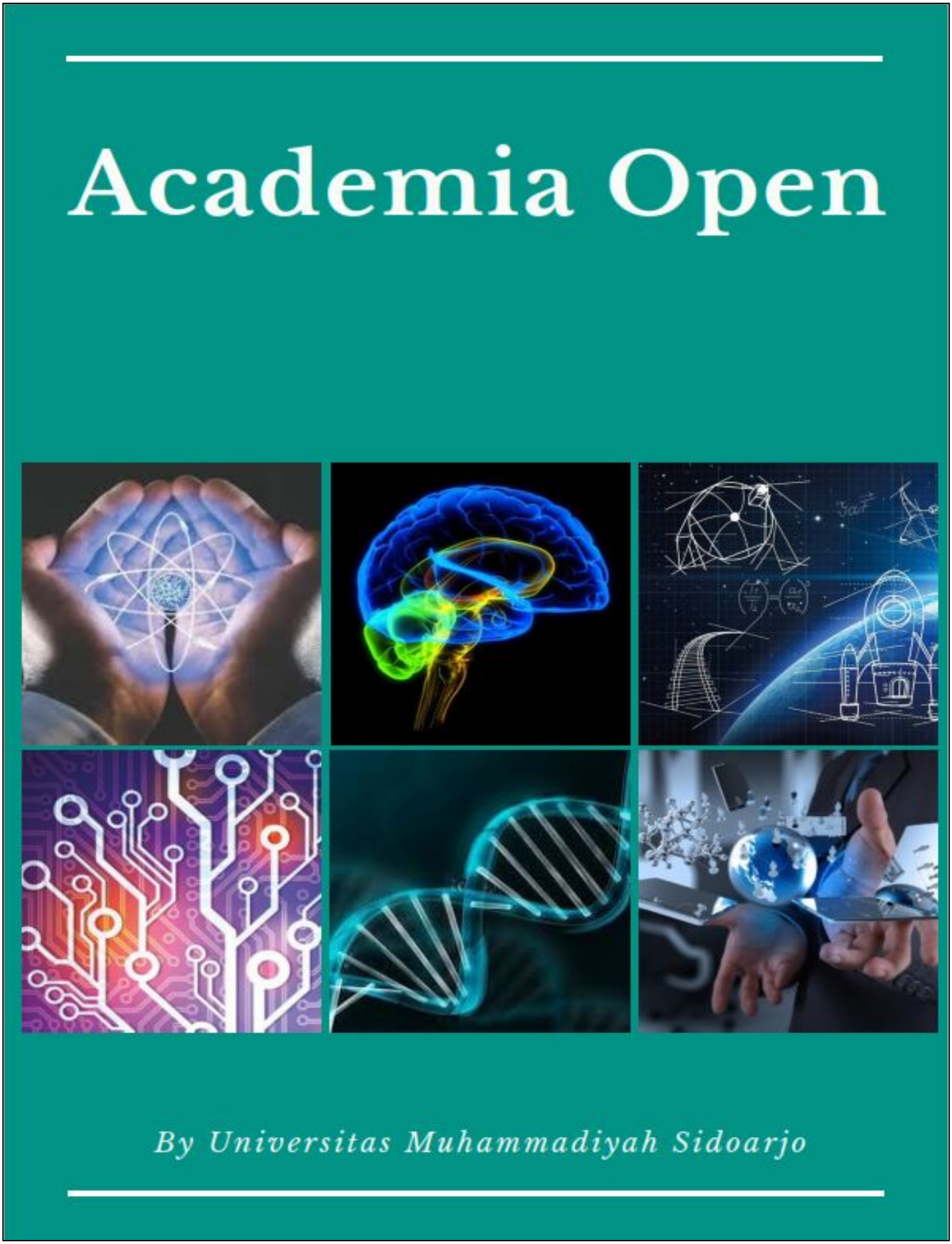

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S. aureus Colonization in Atopic Dermatitis Raises Global Concern

Kolonisasi S. aureus pada Dermatitis Atopik Menimbulkan Kekhawatiran Global

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Abstract

Atopic Dermatitis (AD) is often worsened by *Staphylococcus aureus* colonization, which compromises the skin barrier and increases inflammation. This study aimed to identify risk factors for *S. aureus* infection in AD patients. Swabs from 100 AD patients at Baqubah Teaching Hospital, Iraq, were analyzed from October to February 2023. *S. aureus* was identified in 40% of patients using the Vitek 2 device. Results showed a significant correlation between *S. aureus* colonization and AD, particularly in younger patients, with the highest infection rates in males over 40. These findings highlight the need for targeted treatments to manage *S. aureus* in AD, potentially improving patient outcomes.

Highlights:

1. High Infection Rates: S. aureus found in 40% of AD patients.
2. Age Correlation: Higher colonization in younger AD patients.
3. Targeted Treatment: Emphasize targeted therapies for managing S. aureus in AD.

Keywords: Atopic Dermatitis, Staphylococcus aureus, skin barrier, microbial dysbiosis, infection risk

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Introduction

Atopic Dermatitis (AD) is a prevalent long-term inflammatory skin condition characterized by recurrent Staphylococcus aureus infections. With a prevalence of about 20%, this condition mostly affects newborns and children, especially in wealthy nations. [1,2] Skin barrier inability is a result of AD, a multifactorial complex illness with a range of etiologies and consequences. While some cases go away on their own throughout time, others linger into puberty and may progress to become respiratory allergies like allergic rhinitis or asthma. [3]

The severity of Atopic Dermatitis (AD) can be influenced by a wide range of environmental factors, including exposure to dietary and inhaled allergens, air pollution, weather, and skin microbiome. [4,5] It is commonly recognized that 60%–100% of people with Atopic Dermatitis (AD) have S. aureus colonizing their skin, compared to 5%–30% of healthy controls. Methicillin-resistant S. aureus (MRSA) is also present in 10%–30% of S. aureus isolates from AD patients, albeit this varies by region and the frequency of MRSA infection is rising. We address S. aureus infection as a substantial predictor of AD severity19 in this review, emphasizing its pathophysiologic functions, clinical ramifications, and management in AD skin. [6,7]

Studies show that people with Atopic Dermatitis (AD) have a greater incidence of S. aureus colonization on their skin.[8] Moreover, studies have demonstrated that S. aureus may exacerbate the Th2 immune response in AD patients. It plays a crucial role in the onset of AD. [9] These results imply that S. aureus colonization on AD patients' skin may intensify symptoms of the illness by inducing Th2-mediated immune responses. Emphasize its clinical ramifications, pathophysiologic roles, and available treatments for AD skin. [10]

Enterotoxins from S. aureus can function as superantigens and immediately elicit an immunological response [11]. Additionally, it has been demonstrated that S. aureus's synthesis of toxic shock syndrome toxin-1 (TSST-1) and phenol soluble modulinos (PSMs) worsens Atopic Dermatitis (AD) disease severity by impairing the skin barrier. [12]..

Method

2.1 Collection of samples

Samples were taken from one hundred patients from the Department of Dermatology, Venereology and Allergy at Baqubah Teaching Hospital in Diyala Governorate for the period from October to February, in the year 2023. Atopic dermatitis was diagnosed by a specialist physician by identifying the patient's clinical signs, which include itching, typical morphology, distribution of eczematous lesions, duration of illness, and personal or family history of atopy. Two skin swab samples (S) were taken from each patient. These 100 samples were cultured on solid media to allow the growth of Staphylococcus aureus. We obtained bacterial growth on trypticase soy broth (TSB) agar. for 40 (40% of total) samples derived from 100 AD patients, while the remaining 60 (60%) isolates were cultured and did not show any growth. All isolates with positive growth cultures were tested phenotypically and through antibiotic susceptibility tests.

2.2 Identification of bacterial isolates:

1-Morphological Examinations: The phenotypic traits of the bacterial isolates under investigation were first used to identify them. These traits included the size, shape, color, texture, odor, and makeup of the colonies on blood agar and MacConkey agar media, in addition to their capacity to examine red blood cells on blood agar medium. (13).

2- Microscopic Examinations: A smear of pure colonies growing on the medium was taken using a sterile carrier, placed on a glass slide, distributed evenly and homogeneously, left to dry (for 20 seconds), and stained with Gram stain to see the type of dye, the shape of the cells, and the way they aggregate (14).

3-Diagnosis of isolated bacteria using the Vitek 2 Compact device: The Vitek 2 device is the last and important step in the diagnosis process for (20) pure isolates were selected as belonging to S. aureus bacteria, which are Gram-positive bacteria that belong to people with severe atopic dermatitis. Confirmatory diagnosis using the Vitek 2 device through using (GPI card) of a phenotypic diagnosis card and investigation of antibiotic sensitivity. The test result takes approximately 8 hours. The accuracy of this diagnosis reaches 99%. It is based on various tests to measure the consumption of carbon sources and the enzymatic activity of the bacterial type (15).

Result and Discussion

1 Collection Distribution of study specimens

The current study showed a high prevalence of Atopic Dermatitis among patients. Chronic cases chosen in this study were 100 specimens, which were cultured on solid media to allow the growth of Staphylococcus aureus. We

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obtained bacterial growth on trypticase soy broth (TSB) agar for 40 (40% of the total) from 100 specimens of patients with atopic dermatitis, while the remaining 60 isolates (60%) did not show bacterial growth and other types of bacteria Staphylococcus aureus. All isolates with phenotypically positive growth and antibiotic susceptibility tests were tested. As shown in table (3-1)

		Microbial growth		Total	P value
		Non	Staphylococcus aureus		
atopic dermatitis (AD) (Eczema)	n	60	40	100	p>0.05
	%	60.0%	40.0%	100%	

Table 1. ***Distribution of study specimens***

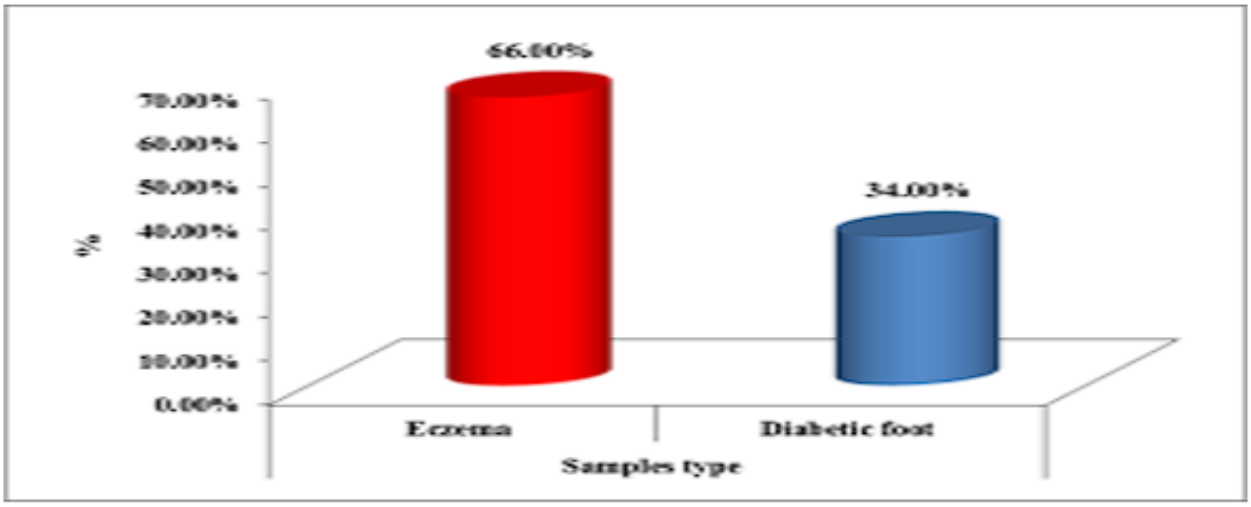

Figure 1. ***Distribution of study specimens***

3.2 Correlation between bacterial Infection and Gender

The current study showed a significant difference in the incidence of atopic dermatitis among males 47 (47.0%). While the infection rate among females was 53 (53.0%) of the total number 100 (100%) of patients. The occurrence of *S. aureus* bacterial growth was 40 (100%), of which 23 (57.5%) were from males and 17 (42.5%). were from females. As shown in table (3-2)

			Microbial growth		Total	P value
			Non	Staphylococcus aureus		
Gender	Males	No	24	23	47	p>0.05
	Females	%	40.0%	57.5 %	47.0%	
	Total	No	36	17	53	
		%	60.0%	42.5%	53.0%	
		No. %	60(100%)	40(100%)	100 (100%)	

Table 2. ***Distribution of S. aureus isolates by gender***

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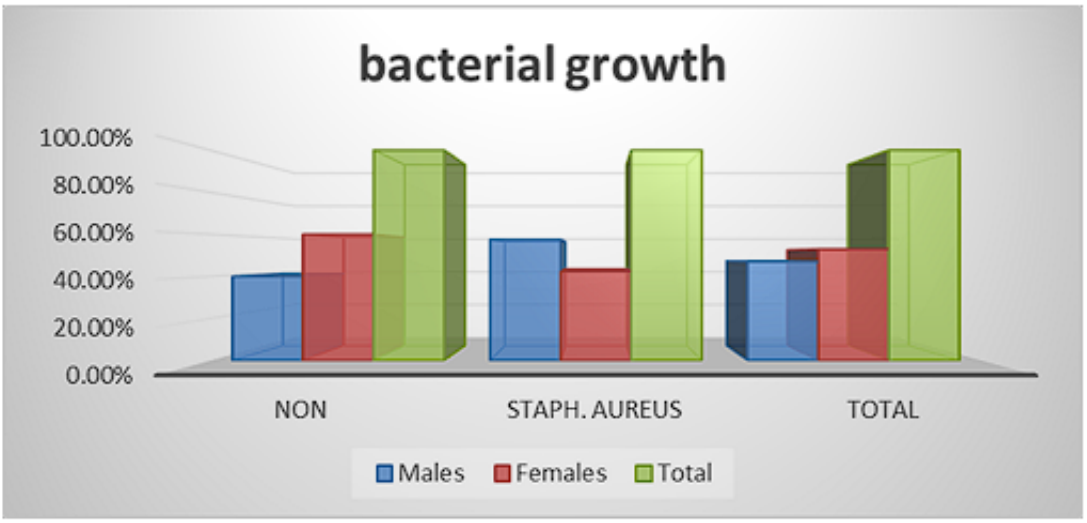

Figure 2. ***Distribution of S. aureus isolates by gender***

The immunological responses to bacterial infections, the etiology of infectious diseases in men and women, and the incidence of autoimmune diseases are all influenced by sex and gender. Women are more likely than men to experience severe reactions to bacterial infections and to develop autoimmune disorders. Immune responses and the sex-related consequences of bacterial infections may be influenced by hormonal, genetic, and environmental variations between men and women. It may be possible to find strategies to lessen negative reactions in females while enhancing immune responses in males by comprehending the mechanisms driving sex inequalities in immune responses. [16] In order to ultimately tailor treatments for males and females, this is required to sufficiently protect both sexes against immune-mediated and infectious diseases**3.3 Correlation between bacterial infection and Age groups**

When comparing the age groups of Atopic Dermatitis patients with the number of bacterial isolates of S. aureus bacteria, it was found that there were clear differences between the age groups. A noticeable increase was found in the age groups over 40 years. It was 57 (57.0%), the highest percentage for those under 40 years of age being 47 (0.47%). As for the presence of bacterial isolates, 13 (32.5%) were in the age group (>60), and 8 (20.0%) were in the age group (41-50), followed by 7 (17.5%) in the age group. (51-60), As shown in table (3-3)

			Microbial growth		Total	P value	
			Non	Staphylococcus aureus			
Age groups (years)	11-20	n	8	3	11		p>0.05
		%	13.3%	7.5%	11.0%	43 43.0%	
	21-30	n	13	5	18		
		%	21.7%	12.5%	18.0%		
	31-40	n	10	4	14		
		%	16.7%	10.0%	14.0%		
	41-50	n	5	8	13	57 57.0	
		%	8.3%	20.0%	13.0%		
	51-60	n	14	7	21		
		%	23.3%	17.5%	21.0%		
	>60	n	10	13	23		
		%	16.7%	32.5%	23.0%		

Table 3. ***Correlation between bacterial infection and Age groups***

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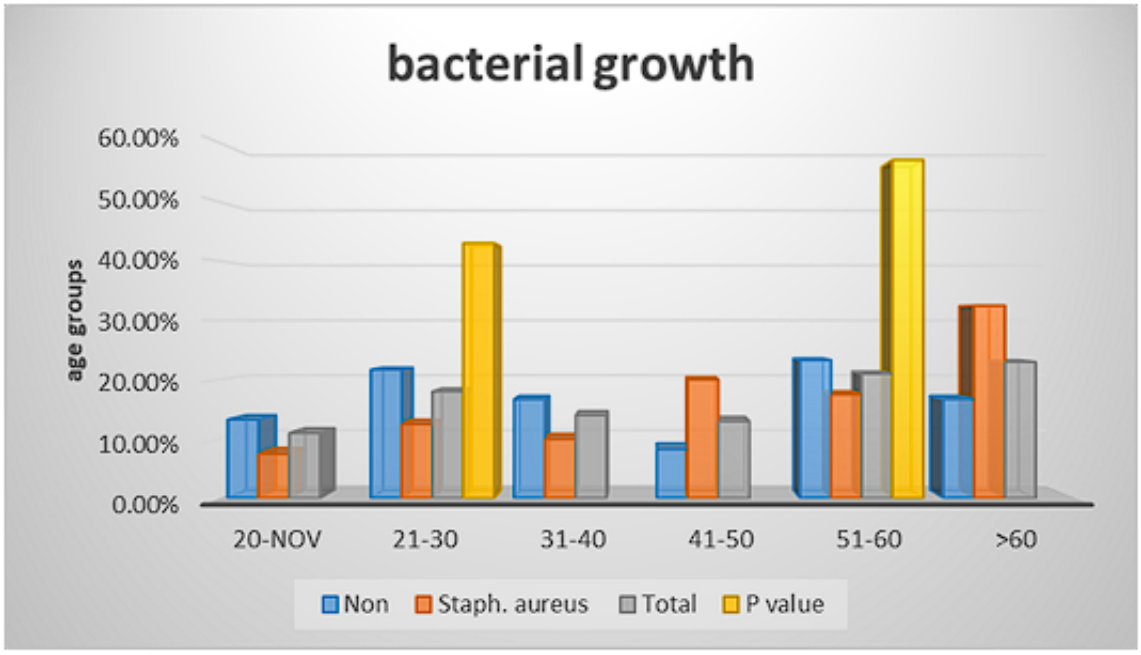

Figure 3. ***Correlation between bacterial infection and Age groups***

When compared to younger persons, the microbial makeup of older adults shows a greater Bacteroidetes ratio [17]. There is evidence to suggest that the microbial composition could Significantly behavioral alterations linked to aging and may affect an individual's exposure to and susceptibility to infectious diseases. In addition to identifying new patterns of infection in people of various ages, behavioral aging may interact, confuse, or neutralize changes in other features that come with aging.[18]

Conclusion

Patients suffering from Atopic Dermatitis frequently have S. aureus invade their skin, which can exacerbate the condition and cause it to worsen. Skin affected by AD is vulnerable to S. aureus colonization due to microbial dysbiosis. In addition to directly compromising the function of the skin barrier, S. aureus raises pro-inflammatory cytokines, which results in skin inflammation. The prevalence of S. aureus has decreased with the usage of antibiotics. Moreover, efforts have been made to rectify the dysbiosis of skin microbes. By managing skin symptoms, we will be able to better understand the role that S. aureus plays in the pathogenesis of AD illness.

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