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Microbiological and Immunological Profiles of Psoriasis and Atopic Dermatitis Patients in Diyala Province, Iraq

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Abstract
Objective: Psoriasis (Ps) and atopic dermatitis (AD) are chronic inflammatory skin diseases, occurring worldwide with high prevalence.
Methods: A case-control study included 70 participants divided into 25 patients diagnosed with psoriasis and 45 patients with atopic dermatitis, whereas the other 30 did not serve as controls. Swab Specimens were examined microscopically and aerobically, and antibiotic susceptibility was conducted on isolated bacteria. Interleukin- 23 and Interleukin-13, C-reactive protein and Complement 3 protein were measured.
Results: *Staphylococcus aureus* was isolated in 61.4% of patients with psoriasis and atopic dermatitis. Resistance of these isolates was significantly high to nalidixic and norfloxacin (100%), whereas most isolates remained sensitive to amikacin (100%). Results of IL-13 and IL-23 revealed higher significant differences between psoriatic and atopic patients and controls in the levels of IL-13 (11.40 ± 4.50pg/mL, 43.80 ± 9.76 for PsO and AD, respectively and 9.70 ± 3.20 pg/mL for controls) and IL-23 (87.90 pg/mL and 25.6 ± 5.80 for PsO and AD, respectively and 13.80 ± 3.66 pg/mL for controls). The result showed that 64.7% of atopic dermatitis patients had a positive CRP test compared to 26.5% of Psoriasis patients and 8.8 % in the control group. C3 level increased in both Psoriasis and atopic dermatitis patients' levels (41.40 ± 4.11 and 39.45 ± 5.76 mg/dl) compared to 25.55 ± 3.18 mg/dl in the control group.
Conclusion: This study found atopic dermatitis (AD) significantly more prevalent than psoriasis in patients. The *Staphylococcus aureus* pathogen exhibited concerning antibiotic resistance. Elevated IL-13 and IL-23 suggest an immune activation pattern common to both diseases.

Keywords: Psoriasis, Atopic Dermatitis, *Staphylococcus aureus*, C-reactive protein (CRP), IL13, IL23,

Plain English Summary

This study investigated patients with psoriasis and atopic dermatitis (AD) in Diyala Province, Iraq, to identify bacterial infections and immune changes linked to these skin diseases. The most common bacterium found was *Staphylococcus aureus*, which showed high antibiotic resistance. Patients also had elevated levels of inflammatory markers (CRP, IL-13, IL-23, and C3) compared to healthy individuals. These findings suggest that bacterial infections may worsen inflammation in psoriasis and AD is helping improve the understanding and management of these conditions.

Background

Psoriasis (Ps) and atopic dermatitis (AD) are widespread chronic inflammatory disorders of the skin with considerable global prevalence. Psoriasis represents a complex immune-mediated condition that affects nearly 1–3% of the world's population and manifests as erythematous, scaly plaques commonly located on the scalp, lower back, and the extensor regions of elbows and knees, as well as involving nails and joints (1). In Iraq, the prevalence of psoriasis varies from 0.5% to 0.7% (2). Atopic

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dermatitis, on the other hand, typically develops during early childhood and is frequently associated with later emergence of asthma or food allergies. It is clinically recognised by severe pruritus and recurring eczematous eruptions, with epidermal barrier dysfunction being a consistent finding despite the disease's marked heterogeneity (3). The prevalence of AD is notably high, particularly in children, affecting 15-30% of this population (4). Historically, psoriasis (PSO) and AD were viewed as mutually exclusive diseases; however, they are increasingly recognised as part of a disease spectrum (5). Recent studies have indicated that interleukins IL-13 and IL-23 are key cytokines contributing to the immunopathogenesis of AD. The complement system, as a fundamental component of innate immunity, plays a vital role in host defence against bacterial invasion. By promoting opsonisation and pathogen breakdown, complement proteins assist in the clearance of immune complexes and the removal of damaged cellular components. Recently, there has been growing acknowledgement of the complement system's involvement in neuroinflammation, ageing, and cancer. This system consists of approximately 50 membrane-bound and soluble proteins, including the classic components C1-C9, most of which are produced by the liver. However, complement proteins are also secreted by various skin cells, including mast cells, macrophages, keratinocytes, and fibroblasts (6). Blood levels of various inflammatory markers, including high-sensitivity C-reactive protein (CRP) and complement C3, are elevated in psoriasis and atopic dermatitis. Despite this, limited epidemiological data exist on the prevalence of these chronic inflammatory skin diseases. Although studies showed relative increases in Streptococcus and Staphylococcus infections in psoriasis and AD patients, and increased resistance to antibiotics (7). Furthermore, the role of microorganisms in the pathogenesis of psoriasis and AD remains incompletely understood. Therefore, this study aimed to isolate and identify the aerobic bacterial agents associated with skin lesions in psoriasis and AD patients, as well as to evaluate serum levels of immunological parameters such as C-reactive protein (CRP) and complement C3, and to assess skin bacterial infections in these patients.

Materials and methods

Study design

A case-control study was conducted on 100 participants from October 2023 to March 2024 in the Biology Department laboratory at the College of Science, University of Diyala. A total of 100 subjects participated in this study, each undergoing a comprehensive clinical history and examination. Blood samples and skin swabs from lesions were collected from 70 patients with psoriasis and atopic dermatitis, aged 35 to 70 years, who had not received systemic or local steroid therapy for six weeks before they visited the dermatology consultation clinic at Baquba Teaching Hospital in Diyala Province, Iraq. Additionally, blood samples and skin swabs were collected from 30 normal individuals, also aged 30 to 65 years, who were free from any infections as determined by a physician's assessment and clinical examination. All details of the participants involved in this study were recorded in a standard proforma, and written informed consent was obtained from all participants.

Diagnostic criteria for psoriasis and AD

The psoriasis and AD were diagnosed by dermatologists based on characteristic skin, nail, and scalp findings.

Inclusion criteria

70 patients with psoriasis and atopic dermatitis, aged 35 to 70 years of both sexes, who had not received systemic or local steroid therapy for six weeks before they visited the dermatology consultation.

Exclusion criteria

Participants who had a medical history of myocardial infarction, advanced cardiovascular disorders, autoimmune or chronic renal diseases, arthritis of any type, including psoriatic arthritis, or malignancy were excluded from the study. Individuals identified as chronic smokers, alcohol consumers, pregnant or breastfeeding women, and those who had undergone recent surgery or sustained a bone fracture within the last three months were also not eligible. Moreover, subjects presenting with clinical signs or symptoms of either acute or chronic infection were omitted from participation.

Specimen collection

A. Swab samples

Sterile flocked swabs were used to collect samples from a 2 x 2 cm area of various lesions of each of the seventy patients. The swabs were immersed in saline to facilitate sample collection. Transport medium swabs were utilised to prevent the samples from drying out until they could be transported to the laboratory.

B. Blood samples

Seventy patients and thirty members of the control group had five millilitres of venous blood drawn for the research. Gel tubes containing each blood sample were left to coagulate at room temperature (between 25 and 30 °C). After

centrifuging the tubes for 10 minutes at 5000 rpm, the serum was carefully transferred into 250 µl Eppendorf tubes and kept at -20 °C for further analysis.

Bacterial Isolation and Identification
All skin lesion specimens were cultivated in various isolation cultures and then incubated aerobically at 37°C for 24 hours. bacterial colonies developed on the culture media of the primary culture were diagnosed based on the culture characteristics in terms of shape, size, colour, texture, smell, and fermentation of lactose sugar in the middle of MacConkey agar and mannitol sugar on the medium of salt mannitol (8), then it was subjected to a microscopic examination by taking a swab, fixing it with heat, staining it with gram stain, and then examining it under the oil lens of the optical microscope, several biochemical tests have been performed such as catalase and oxidase test, plasma coagulation test, Citrate utilization test, Urease hydrolysis test, and Indole production test as reported by approved diagnostic systems (9).

Antibiotic susceptibility test (AST)
All isolates underwent AST using the Kirby-Bauer disc diffusion technique with Muller-Hinton (MH) agar in accordance with the Clinical Abortion Standards Institute (CLSI) guidelines (CLSI, 2021) (10).
The antibiotic discs (BioMérieux (USA)) used in this study were Carbapenems (10µg), Imipenem (10µg), Aminoglycosides, Amikacin. Fluoroquinolones, Nalidixic, Ofloxacin, Norfloxacin, Imipenem (10 µg), Nalidixic(30µg), Norfloxacin (19µg), Ofloxacin(5µg), Amikacin (30 µg).

Immunological parameters study
Serum levels of CRP were measured by a qualitative latex agglutination test (Turki), and Complement 3 protein was determined by radial immunodiffusion plate (11). Qualitative method: Fifty microliters (approximately one drop) of each smoker's serum was transferred into the test circle on the latex card, and one drop of the C-reactive protein (CRP) latex reagent was added. The drops were mixed using a disposable wooden stick, and the mixture covered the test circle. Gently and evenly, the test card was rotated for 5 minutes.
Serum concentrations of IL-13 and IL-23 were quantified using enzyme-linked immunosorbent assay (ELISA). A sandwich-ELISA method was employed according to the manufacturer's instructions for IL-13 (Sunlong, China; REF SL0974Hu) and IL-23 (Sunlong, China; REF SL0989Hu). Each microplate was pre-coated with antibodies specific to human IL-13 and IL-23. The samples were then added, allowing the cytokines to bind to the immobilised antibodies. The degree of colour development in the substrate solution was directly proportional to the concentration of IL-13 and IL-23 in the samples. The reaction was terminated with an acidic stop solution, and optical density was measured at 450 nm using an ELISA reader (Mindray, China).

Statistical Analysis
The data were analysed using SPSS (Statistical Package for the Social Sciences) software, version 17.0. The Chi-square test of significance was used to compare the categorical variables, while the Student's t-test of independence was used to evaluate the continuous variables. The level of significance in all statistical significance evaluations was the 95% confidence level (P value <0.05) for the confidence interval.

Results and Discussion
Disease Prevalence in Patients
Overall, data were collected for analysis from studied population, as shown in Figure 1. Two skin conditions were analysed: psoriasis and atopic dermatitis. Among the 70 patients, psoriasis was identified in 25 individuals, representing 35.7% of the total cases. In contrast, atopic dermatitis was diagnosed in 45 patients, accounting for 64.3% of the sample, with a statistically significant difference, a p-value ≈ of 0.016, which is less than 0.05, indicating that atopic dermatitis was more common than psoriasis in this cohort.

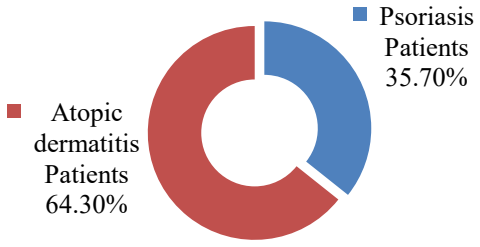

Figure 1: Distribution of Patients with Psoriasis and Atopic Dermatitis

This study found that the prevalence of psoriasis was higher in compared with their AD cohorts. Prevalence can vary by geography, ethnicity, and environmental factors. If your cohort is from a region with high allergen exposure or urban pollution (known AD triggers). These findings support results from a previously published study of patients in Japan by Marani *et al.* (12), analysed data from the JMDC database and similarly reported a notable prevalence of comorbidities. Generally, a detection bias may exist regarding dermatologic comorbid conditions among disease cohorts, as these patients tend to visit dermatologists more frequently than individuals in the matched control groups.

The Percentage of Psoriasis and Atopic Dermatitis Infection According to sex and age.
The results, as listed in Table 1, showed that the percentage of psoriasis and atopic dermatitis infection in 46 males (65.7%) was higher than in 24 females (34.3%). In addition, patients and controls were categorised into two groups. The higher percentage of ages of infection in patients and controls was located within the > 40 age category, with 44 patients (62.9%) and 18 controls (60.0%). There was a highly statistically significant difference between the two groups regarding sex and age.

Table 1: Basic characteristics of psoriasis and atopic dermatitis patients

Categories			Groups		Total
			Patients (70)	Control (30)	(100)
Sex	Males	N	46	20	66
		%	65.7 %	66.6 %	66 %
	Females	N	24	10	34
		%	34.3 %	33.3 %	34 %
Age groups	≤40	N	26	12	38
		%	37.1 %	40 %	38 %
	> 40	N	44	18	62
		%	62.9 %	60 %	62 %

In this study, the higher percentage of psoriasis and atopic dermatitis infections in males compared to females could be attributed to biological, hormonal, or environmental factors that predispose males to these conditions. Research has shown that males may have different immune responses or skin characteristics, which can influence the development of inflammatory skin diseases (12). This higher proportion of men with psoriasis is also observed in other European studies, such as Ferrándiz et al. in Spain (2.4% vs. 1.9%) and Radtke et al. in Germany (2.90% vs. 2.59%) (13). In contrast, other studies report a higher prevalence of psoriasis in women, such as Stern et al. in the U.S., which found 2.5% in women compared to 1.9% in men (14). Upon examining the age to the best of our knowledge, this represents the first population-based epidemiological study on AD and psoriasis in the elderly. The significant prevalence of infections among individuals over 40 years of age suggests that age-related factors, such as changes in skin barrier function, immune response, and exposure to environmental triggers, may contribute to the onset of psoriasis and atopic dermatitis. As people age, the skin tends to become thinner and less resilient, making it more susceptible to inflammatory conditions. Psoriasis and atopic dermatitis demonstrate a biological connection with the ageing process, evident in their disease profile. These results concur with the fact that it is a chronic disease, and patients who start this disease at earlier ages accumulate over the years. The study highlights the high incidence of active AD in both young and old people (15), which may lead to a shift in primary AD care towards older populations (16). Further studies have revealed distinct immunological responses in older AD patients, which are typified by lower serum IgE and eosinophil levels, and they point to connections between AD and the ageing of many systems, from both pre-diseased and diseased perspectives (17).

Identification of Bacterial Isolates
In general, all the skin swabs that were isolated from 70 patients were cultured in brain heart infusion (BHI) broth and incubated aerobically for 24 hours at 37°C to promote bacterial growth. The laboratory culture results indicated that 60 (85.7%) of the total samples exhibited bacterial growth. While the remaining samples of 10 (14.3%) did not show any bacterial growth. Microscopic examination was conducted on the 60 culture-positive samples using Gram staining to assess their reaction to the stain. Results showed that 43 isolates (61.4%) were classified as Gram-positive bacteria, exhibiting a cocci shape primarily arranged in clusters. This clustering phenomenon arises from the division of Staphylococcus species by binary fission in

three planes. In contrast, 17 isolates (24.3%) were identified as Gram-negative bacteria from the total samples, as shown in Figure 2.

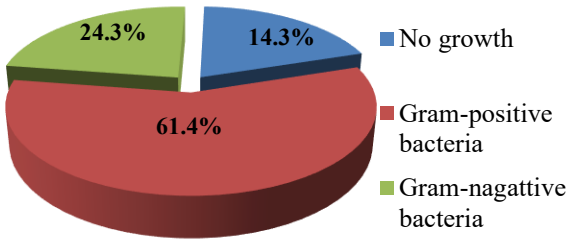

Figure 2: The percentage of bacterial species isolated

The laboratory culture results indicated that 60(86.86%) of the total samples exhibited bacterial growth. This high prevalence may be attributed to factors such as the number of samples examined, as well as the socioeconomic status, age, and gender of the individuals from whom the samples were collected. Conversely, 10(14.14%) samples did not demonstrate bacterial growth. This lack of growth may be due to the presence of pathogens other than bacteria, such as viruses, parasites, or chlamydia, which were not detectable in this study. Additionally, it may reflect the effectiveness of the antibiotics administered for treating bacterial infections. The results of bacterial isolation align with findings reported by Lika *et al.,* which indicated that 65% of isolates tested positive for bacterial growth (18). The results of this study are consistent with findings from (19, 20, 21) which identified *Staphylococcus aureus* as the predominant bacterium, 80–100% are colonised among various bacterial isolates patients with AD. Additionally, a study conducted in Pakistan, which analysed approximately 265 bacterial samples from diverse clinical sources, also confirmed that *S. aureus* is the predominant pathogen (22).

For further purification, *S. aureus* isolates were cultured on blood agar plates. After 24 hours of incubation, the resulting *S. aureus* colonies appeared as large, round, creamy to buff-colored colonies, exhibiting a wide zone of complete hemolysis with blurred edges, characteristic of β-hemolysin. For more identification, several biochemical tests were conducted to differentiate *Staphylococcus aureus* from the genus Micrococcus. The oxidase test was performed on the isolates, yielding a negative result, indicating the absence of the cytochrome oxidase enzyme. The catalase test was conducted, and all isolates produced positive results, distinguishing staphylococci from streptococci, which typically yield negative results. The positive catalase test confirms the ability of the isolates to produce the enzyme catalase, which facilitates the conversion of hydrogen peroxide (H_2O_2) into water and oxygen (23).

Coagulase is performed to identify the bacterial isolates at the species level, positively distinguishing *S. aureus* from other Staphylococcus spp. Thus, tubes with coagulase production are considered the "gold standard" for the identification of *S. aureus,* and all the 40 isolates were coagulase positive, which differentiated staphylococci from streptococci that normally gave a negative result. Additionally, the indole test was performed, resulting in a negative outcome, as indicated by the presence of a yellow ring on the surface of the peptone water medium. The urease test was also positive, suggesting that the isolates possess the urease enzyme, which hydrolyses urea into ammonia and carbon dioxide. This reaction causes an increase in pH, leading to a colour change in the medium from pale yellow to pink, as indicated by the phenol red indicator. Furthermore, positive results were obtained for the methyl red and Voges-Proskauer tests. Notably, the addition of Kovacs reagent indicated the inability of these bacteria to produce the tryptophanase enzyme, which breaks down tryptophan into indole. The results of the identification tests for *S. aureus* isolates are presented in Table 2.

Table 2: Biochemical assays for the identification of *S. aureus*.

Bacteria	Biochemical Tests					
	Catalase	Oxidase	coagulase	Indole	Citrate	Urease
S. aureus	+	-	+	+	+	+

(+) positive result, (-) negative result, (MR) Methyl red, (VP) Voges –Proskauer test, (KIA) Kliger Iron Agar test, (K/K) Alkaline Slant/ Alkaline Bottom.

In addition, this study assessed the susceptibility of bacteria to antibiotics; the results of AST are shown in Figure 3. The antibiotics, Imipenem 10 µg), from the Carbapenems family exhibited a resistance rate of 71.5 %. In contrast, the antibiotics Nalidixic(30µg), Norfloxacin (19µg) demonstrated 100 % resistance. Ofloxacin (5µg) showed a resistance rate 57%, while Amikacin 30 µg was showed 0 % resistance.

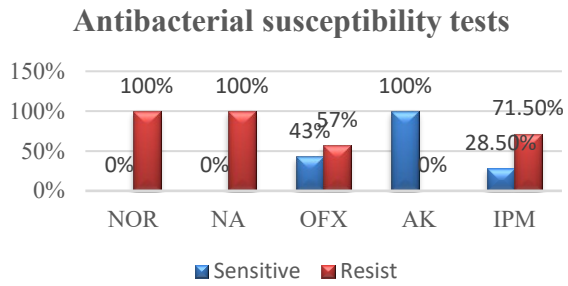

Figure 3: Antibacterial susceptibility test.

The results in Table 3 showed that Staphylococcus aureus was 28.5% sensitive to imipenem and 100% sensitive to amikacin. And these results were in agreement with (24).
Our current results are similar to those of Moosavian et al. (25), who demonstrated in their study of the sensitivity of Staph aureus bacteria to antibiotics, including imipenem and amikacin, that the sensitivity rates for these antibiotics were 83.1% and 100%, respectively. In addition, the results of Naimi et al. (26), whose isolates showed 90% and 100% sensitivity to imipenem.
Staphylococci also demonstrated high resistance to the other antibiotics used in the study. This high resistance is attributed to the bacteria possessing beta-lactamase enzymes that degrade the penicillin group, whose genes are either chromosomal or plasmid-derived. These bacteria also produce penicillin-binding proteins (PBPS) located in the cytoplasmic membrane that are attached to the cell wall. These proteins are a target for both penicillin and cephalosporin antibiotics, as they alter the target site of the beta-lactam antibiotics, resulting in bacterial resistance to them (27). Nalidixic Acid, imipenem and Norfloxacin resistance were high, which is frightening and clinically significant. Complete resistance means that antibiotics no longer work against the tested isolates, indicating the spread of multidrug-resistant bacteria. Since Norfloxacin and Nalidixic Acid are quinolones, which are first-line treatments for urinary and gastrointestinal infections, this finding is concerning.

Level of Some Immune Parameters in Psoriasis and Atopic Dermatitis Patients Compared to Healthy People

In this study, a highly statistically significant difference was observed in the level of certain immune markers between psoriasis and atopic dermatitis patients and healthy people. These findings are crucial as they suggest that immune disorders may contribute to the development of psoriasis and atopic dermatitis, highlighting distinct differences in immune system response to patients compared to healthy people.

Serum levels of interleukins (IL-13 and IL-23) Among Study Groups

Table 3 shows the results of serum levels of IL-13 and IL-23. Serum levels revealed higher significant differences (p=0.0003 and p=0.0007), respectively, between psoriatic and atopic patients and controls in the levels of IL-13 (9.70 ± 3.20 pg/mL for controls and 11.40 ± 4.50pg/mL, 43.80 ± 9.76 for PsO and AD cases, respectively) and IL-23 (13.80 ± 3.66 pg/mL for controls and 87.90 pg/mL and 25.6 ± 5.80 for PsO and AD cases, respectively). These findings suggest a potential role of IL-13 and IL-23 in the pathophysiology of both psoriasis and atopic dermatitis.

Table 3: Comparison of IL-13 and IL-23 Serum levels Among Study Groups

Parameters	Psoriatic patients (25)	Atopic dermatitis patients (45)	controls (30)	*P-value*
L-13, pg/mL	11.40 ± 4.50	43.80 ± 9.76	9.70 ± 3.20	P=0.0003
L-23, pg/mL	87.90 ± 17. 97	25.6±5.80	13.80 ± 3.66	P=0.0007

Note: IL-13 – interleukin-13, IL-23 – interleukin 23

Psoriasis and atopic dermatitis are skin diseases that are caused by immune system dysfunction, and it is associated with various other diseases such as cardiometabolic

diseases, psoriatic arthritis, and mental health issues. This makes it a significant financial burden and a global health risk (28). The current study found that the mean level of IL-13 and IL-23 in patients' serum was significantly higher than the controls' serum ($P < 0.01$). As for psoriasis patients, this result is in contrast to the findings of (29), who found a decreased expression of IL-13 in psoriatic patients when compared to atopic dermatitis patients. The present study showed that IL-13 levels in patients with PsO were significantly higher than controls. Similar findings were noted by (30). Another study by (31) showed similar results compared to the control. For atopic dermatitis patients, current findings are consistent with those reported by the study (32), which demonstrated that IL-13 is secreted primarily by type 2 innate lymphoid cells (ILC2s) and Th2 lymphocytes, showing elevated levels in the skin tissues of patients with atopic dermatitis (AD). The receptor for IL-23, selectively expressed on Th17 cells, consists of two distinct subunits—IL-23R and IL-12Rβ1. In the present analysis, IL-23 expression was markedly higher in psoriasis cases compared with AD, although AD samples also exhibited a moderate increase relative to the control group.

C-reactive protein (CRP) Levels in Psoriasis and Atopic Dermatitis patients

The result showed that 64.7% of atopic dermatitis patients had positive PCR test compared to 26.5% of Psoriasis patients and 8.8 % in the control group ($P< 0.001$).

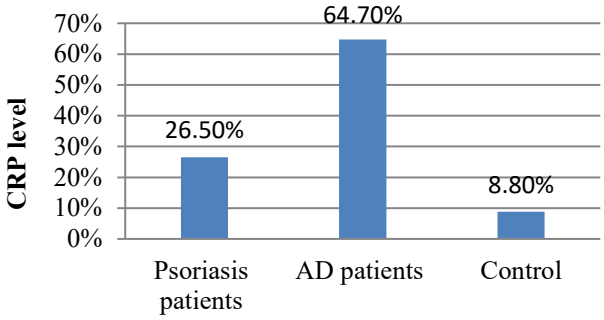

Figure 4: Comparison of CRP Serum Level Among Study Groups

CRP is the most studied proinflammatory biomarker, and has been inconsistently linked to psoriasis and atopic dermatitis severity (33). It is analytically stable and reproducible. CRP is produced in the liver (hepatocytes) through the action of IL-6 and IL-17, and other chemokines. In our study, serum CRP level was found to be raised in psoriasis and atopic dermatitis patients than in controls (64.7%,26.5% vs 8.8 %, $p<0.001$). This marked difference suggests that atopic dermatitis may involve a more pronounced systemic inflammatory component, potentially linked to its pathophysiology, which often includes a defective epidermal barrier and a heightened immune response. The substantial elevation in CRP levels could indicate increased inflammation, possibly due to ongoing skin lesions or secondary infections commonly seen in atopic dermatitis. Numerous investigations have revealed that biological agents, particularly the reduction of CRP levels during the administration of various biological agents, regulate inflammatory responses in the therapy and amelioration of psoriasis. This agrees with the present study findings (34). This was in concordance with other studies done by various authors (35, 36).

Under pathogenic stimuli, myeloid dendritic cells (DCs) become activated and produce excessive levels of inflammatory cytokines, such as IFN-α, tumour necrosis factor-alpha (TNF-α), and IL-6. These cytokines, in turn, promote the increased secretion of IL-12 and IL-23 (37). In response to IL-23, Th17 cells produce high levels of IL-13, which acts on keratinocytes, leading to epidermal hyperplasia, activation of innate immune responses, recruitment of leukocytes to the skin, and further production of pro-inflammatory cytokines such as IL-1β, IL-6, and IL-8 (38). Blocking IL-17 can disrupt this pathological cycle, effectively reducing inflammation and alleviating clinical symptoms of psoriasis (39).

Complement 3 (C3) levels Among Study Groups

The results of C3 level, as shown in Table 5, indicate an increase in serum level of both Psoriasis and atopic dermatitis patients, with a mean level (41.40 ± 4.11 and 39.45 ± 5.76 mg/dl) compared to 25.55 ± 3.18 mg/dl in the control group, with highly statistically significant differences ($P= 0.001$).

Table 4: Comparison of Complement 3 Serum levels among studied groups

Parameters	Psoriatic patients (25)	Atopic dermatitis patients (45)	controls (30)	*P-value*
Complement 3mg/dL	41.40 ± 4.11	39.45 ± 5.76	25.55 ± 3.18	P=0.001

Complement 3 is derived from human keratinocytes in epidermal basement membrane deposits C3. Duarte *et al.* (40) Report that cutaneous keratinocytes make and secrete C3. In addition, C3 derived from epidermal keratinocytes can also be attributed to the deposition of C3 on the lower membrane of epidermal cells in autoimmune or inflammatory disorders. Terui *et al.* (41) reported that keratinocyte production from inflammatory mediators such as C3 was affected by fair leukocyte migration to the epidermis.

The current study is consistent with a local study by previous studies by Kutukculer et al. (42) and Chimenti *et al*. (43) where serum levels of C3 and C4 were significantly elevated in psoriasis patients compared to healthy controls, which indicates that the complement system is undoubtedly activated in psoriasis patients. High levels of C3 and C4 also indicated an increase in incorrect complement system activity, which leads to significant tissue damage through increased deposition of human keratinocytes, which play a major role in causing disease.

The elevation of IL-13 and IL-23 levels in both psoriasis and atopic dermatitis patients underscores their potential roles as key immunological mediators in the pathogenesis of these chronic inflammatory skin diseases. The recommendation of this study is that modulation of the therapeutic for IL-13 and IL-23 pathways could lead to the development of more effective biologic treatments and preventive strategies for psoriasis and atopic dermatitis.

Conclusion

This study found atopic dermatitis (AD) significantly more prevalent than psoriasis in patients. The *Staphylococcus aureus* pathogen exhibited concerning antibiotic resistance. Elevated IL-13 and IL-23 suggest an immune activation pattern common to both diseases.

List of Abbreviations

AD: Atopic Dermatitis
CRP: C-Reactive Protein
C3: Complement Component 3
IL-13: Interleukin-13
IL-23: Interleukin-23
S. aureus: Staphylococcus aureus

Declarations

Ethical approval and consent to participate

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The study was performed following the acquisition of both verbal and written consent from the patients before collecting the samples. This case-control study was approved by the University of Diyala, as well as the study was also approved by the Ministry of Health in Iraq 69264 in dated 5\12\2023.

Consent for publication

All the authors gave consent for the publication of the work.

Availability of data and materials

The data and materials associated with this research will be made available by the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

Nil.

Authors' Contributions

Ibtihal Hameed Mohsin and Lina Abdulameer Salman Alsaadi conceived and designed the study. All authors participated in sample collection and analysis. All authors reviewed and approved the final version of the manuscript before submission.

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Not applicable.

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