

Assessment of serum interleukin 5 levels in patients with psoriasis vulgaris

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ABSTRACT

Background: Psoriasis is an autoimmune disease that is chronic, inflammatory, and caused by T cells. It affects the skin, nails, mucous membranes, and joints, yet not the hair. It affects about 2–3% of people worldwide, equally divided between the sexes. It affects people from 1 to 18 years old. **Objective:** The objective was to assess the serum level of IL-5 and establish a relationship between it and the severity of psoriasis vulgaris in patients with mild, moderate, and severe cases. **Materials and Methods:** This case–control study was conducted over the course of six months, from November 2020 to April 2021 at the Beni-Suef University Hospital’s outpatient clinic for dermatology, venereology, and andrology. Fifty patients with varying degrees of psoriasis vulgaris and forty age- and sex-matched, seemingly healthy controls were included in the study. A physical examination, history, and family history were all taken into consideration for the diagnosis, which was also supported by a thorough cutaneous examination of every case. The Psoriasis Area Severity Index (PASI) score was used to grade them. Furthermore, 5 mL of blood was taken out for testing. **Results:** IL-5 levels were noticeably higher in the PV group than in the control group. **Conclusion:** The current study may add to our understanding and provide some insight into the potential involvement of IL-5 in the pathophysiology of psoriasis. Biologic treatments against IL-5 may be useful in the treatment of psoriasis.

Key words: Serum level; Interleukin 5; Psoriasis vulgaris

INTRODUCTION

The current study may add to our understanding and provide some insight into the potential involvement of IL-5 in the pathophysiology of psoriasis. Biologic treatments against IL-5 may be useful in the treatment of psoriasis [1, 2].

While the exact cause of psoriasis remains unknown, a number of proinflammatory cytokines (e.g., TNF- α , IL-17, IL-1, IL-6, IL-22, IL-23), as well as several cytokine receptors, have been linked to its pathogenesis. Some of these are currently being studied as potential treatment targets [3, 4].

Interleukin 5 (IL5), also known as eosinophil differentiation factor (EDF), is a cytokine that specifically promotes the production of eosinophils [5]. It regulates the initiation and proliferation of eosinophils [6].

Hence, it is imperative in the management of conditions such as asthma that are associated with heightened eosinophil counts. In contrast to other cytokines (e.g., GCSF, IL2, and IL4), IL5 exists in a homodimeric structure, whereas the aforementioned cytokines are monomeric in nature. The fold contains a left-handedly twisted anti-parallel 4- α -helix bundle and a 2-stranded anti-parallel beta-sheet that serves to connect them [7]. Two disulphide bonds serve to maintain the chain structure [8].

MATERIALS AND METHODS

Subjects

Fifty patients with mild, moderate, and severe psoriasis vulgaris (the patient group) and forty subjects with age, sex, and BMI matching the control

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group were included in this prospective case-control study. The study was conducted over the course of six months, from November 2020 to April 2021, in the outpatient clinic for dermatology, venereology, and andrology at Beni-Suef Hospital. Prior to drawing blood samples, each participant gave their informed consent.

Ethical consideration

The Beni-Suef University Faculty of Medicine's Dermatology and Andrology Department as well as the Ethics Committee gave their approval to this study.

Inclusion criteria

Individuals suffering from psoriasis vulgaris varying in age and sex. Individuals classified as having mild, moderate, or severe psoriasis vulgaris based on their PASI score.

Exclusion criteria

The study comprised guttate, erythrodermic, pustular, and psoriatic arthritis patients. Patients with diabetes, cancer, hepatic, renal, or cardiovascular problems were excluded from the trial. Those who had systemic anti-psoriatic therapy or phototherapy within a month of the research were also excluded. The study also excluded pregnant and breastfeeding women.

METHODS

The following criteria were met for each patient who was a part of the research.

Full history taking

Including past medical records related to drug use, systemic diseases, skin conditions, and psoriasis vulgaris, as well as personal and family medical histories.

Clinical examination

Full physical examination, incorporating the measurement of BMI. Thorough examination of the skin to determine the clinical type and severity of psoriasis. Grading psoriasis based on PASI score.

Laboratory investigations

By utilizing the ELISA technique, aseptic conditions were maintained while obtaining 5 mL of venous blood samples from both patients and controls. The purpose

was to measure the levels of serum interleukin 5 in individuals with psoriasis.

Enzyme-linked immunosorbent assay (ELISA)

Solid-phase enzyme immunoassay (EIA) is a commonly employed analytical biochemistry method that employs antibodies specific to the protein of interest to detect the presence of a ligand, typically a protein, in a liquid sample.

Assessment of serum IL-5

The kit measures human IL-5 in microtiter plate wells coated with purified human IL-5 antibody to produce solid phase antibody. After washing, apply IL-5 to wells. The antibody-antigen-enzyme-antibody complex contained HRP-labeled goat anti-human. Adding TMB substrate solution. The HRP enzyme turns TMB blue. Add sulfuric acid to stop the reaction. The color change is detected spectrophotometrically at 450 nm. Compare the O to determine the sample's IL-5 content. Difference between sample and standard curve.

Assay procedure

Standard concentrations were 18ng/L, 12ng/L, 6ng/L, 3ng/L, and 1.5ng/L. The standards were diluted with standard dilution and added to standard wells on the ELISA plate. Add 10 µL of each sample to the testing sample, followed by 40 µL of sample diluent. Mix the samples well, but do not add any sample or conjugate to the blank. Incubated at 37°C for thirty minutes. The liquid was disposed of after each well was aspirated and cleaned. Next, 300 µL of wash solution was added to each well using an auto washer, manifold dispensers, or a squirt bottle. For optimal performance, all liquid had to be completely removed at every stage. Any leftover wash solution was aspirated or decanted after the final wash. The plate was turned over and blotted with fresh paper towels. Step 4 involved washing each well after adding 50 µL of HRP-conjugate reagent, covering it with an adhesion strip, and incubating it for thirty minutes at 37°C. 50 µL of both chromogen solutions A and B were introduced into every well. After gently mixing, incubate at 37°C for fifteen minutes. shielded from the light. For every well, 50 µL of stop solution was added. The wells' color transitioned from blue to yellow. In less than fifteen minutes, the optical density at 450 nm was determined using a microtiter plate reader.

Statistical Analysis

The data was analyzed using IBM SPSS Statistics 25.0. The Shapiro test assessed data normality. Mean \pm SD and median (range) summarized parametric and non-parametric data, respectively. Frequencies and percentages summarized categorical data.

Student's *t*-test compared the means of the two groups. Mann–Whitney U assessed differences in non-parametric data. Kruskal–Wallis assessed differences between >2 groups. Chi-squared tested relationships between categorical variables. Fisher's exact test was used when $>20\%$ cells had an expected count <5 .

Correlation analysis assessed the strength of the association between the two quantitative variables. ROC curve analysis evaluated the sensitivity and specificity of diagnostic measures.

Logistic and linear regression predicted risk factors, with odds ratios and 95% CIs calculated.

$p < 0.05$ was considered statistically significant at a 95% confidence interval.

RESULTS

The current investigation involved a group of fifty individuals with psoriasis, as well as forty individuals who were considered healthy controls.

Baseline Data

The group with psoriasis had a mean age of 38.3 years, with 25 men (or 50% of the group) and 25 women (or 50% of the group), additionally to forty age- and sex-matched, healthy control subjects ($p > 0.05$ for each). The BMI of the psoriasis group was significantly higher than that of the control group ($p < 0.001$) (Table 1).

The psoriasis group showed a positive family history in 18.8% and a negative family history in 81.2% (Table 2).

Clinical Data

The median age of onset was 31 years (range: 9–57), and the median disease duration was five years (range: 1–24). Koebner's phenomenon was positive in 10.4%. The median baseline PASI score was 10.6 (range: 2.2–40.3). Cases were classified as mild (39.6%), moderate (39.6%), or severe (20.8%) based on PASI scores (Table 3) (Fig. 1).

Table 1: Comparison of demographic and anthropometric data of the studied groups

		Control <i>n</i> =40		Psoriasis <i>n</i> =50		<i>p</i>
Age (yrs.)	Mean \pm SD	35	9.1	38.3	11.6	0.131
Males	<i>n</i> , %	22	55%	25	50%	0.838
Females	<i>n</i> , %	18	45%	25	50%	
BMI (kg/m ²)	Mean \pm SD	23.9	2.9	26.7	4.6	< 0.001

SD=standard deviation; Student's *t*-test was used for numerical parameters; Chi-squared test was used for categorical parameters

Table 2: Family history among the studied cases

	Psoriasis <i>n</i> =50	
Positive FH		
<i>n</i> , %	40	81.2%
<i>n</i> , %	10	18.8%

Table 3: Clinical features in the studied cases

		Psoriasis <i>n</i> =50	
Age of onset (yrs.)	Median (range)	31	9–57
Disease duration (yrs.)	Median (range)	5	1–24
Positive Koebner's phenomenon	<i>n</i> , %	5	10.4%
PASI	Median (range)	10.6	2.2–40.3
Mild	<i>n</i> , %	19	39.6%
Moderate	<i>n</i> , %	19	39.6%
Severe	<i>n</i> , %	12	20.8%

IL-5 Level among Studied Subjects

The median IL-5 level was significantly higher in the psoriasis group (35.2 ng/L, range: 14.6–223) when compared to the controls (8.4 ng/L, range: 2–16.8) ($p < 0.001$). (Tables 4 and 5) (Figs. 2 and 3).

ROC Curve for IL-5 Level

IL-5 showed high accuracy in discriminating between the psoriasis cases and controls (AUC = 0.992). At a cut-off of 15.4 ng/L, it had 97.9% sensitivity, 95.8% specificity, 95.9% PPV, 97.9% NPV, and 96.9% accuracy. IL-5 also showed high accuracy in discriminating between mild/moderate and severe psoriasis (AUC = 0.995). At a cut-off of 46.8 ng/L, it had 100% sensitivity, 94.7% specificity, 83.2% PPV, 100% NPV, and 95.8% accuracy (Table 6) (Fig. 4).

IL-5 Level According to Other Parameters

Median IL-5 levels increased with psoriasis severity (mild 18.7 ng/L, moderate 38.6 ng/L, severe 92.4 ng/L; $p < 0.001$) and were higher with positive vs. negative Koebner's phenomenon (91.8 vs. 34.7 ng/L; $p = 0.012$). IL-5 levels did not differ significantly by sex, BMI, or family history in the psoriasis group ($p > 0.05$) (Table 7) (Figs. 5 and 6).

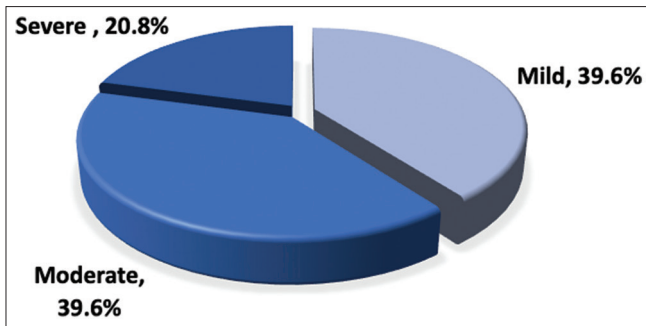


Figure 1: Severity grades in the studied cases.

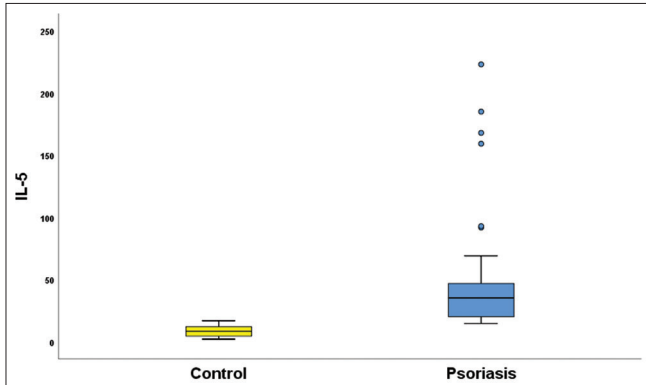


Figure 2: IL-5 level in the case and control groups.

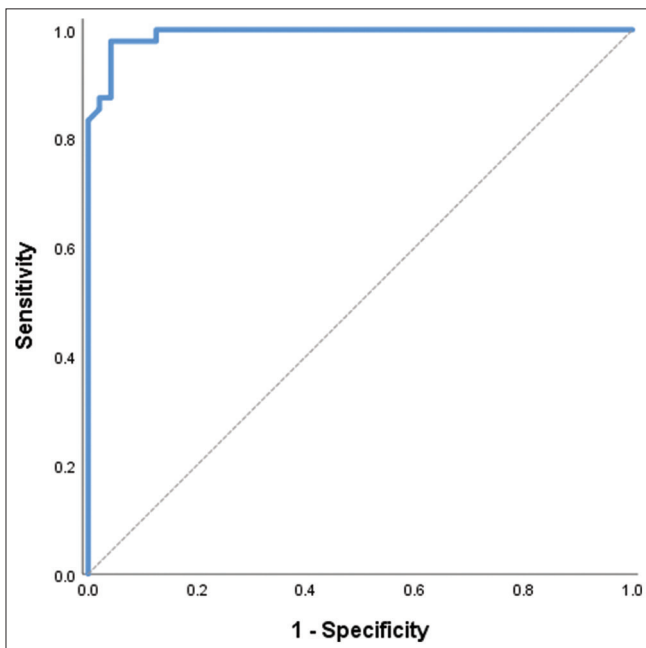


Figure 3: ROC curve of the IL-5 level for discrimination between the case and control groups.

Correlation of IL-5 Level with Other Parameters

A strong positive correlation was observed between IL-5 and PASI score ($r_s = 0.943, p < 0.001$), yet no significant associations were detected with age, onset,

Table 4: Comparison of IL-5 level between the case and control groups

	Control n=40		Psoriasis n=50		p
	median	range	median	range	
IL5 ng/L	8.4	2–16.8 ng/L	35.2	14.6–223 ng/L	< 0.001

Mann–Whitney test was used for comparison of numerical parameters

Table 5: Validity of IL-5 level for discrimination between the case and control groups

	IL-5
AUC	0.992
Cut-off	15.4
Sensitivity (%)	97.9
Specificity (%)	95.8
PPV (%)	95.9
NPV (%)	97.9
Accuracy (%)	96.9

AUC, area under ROC, OC, receiver operating curve; PPV=positive predictive value; NPV=negative predictive value.

Table 6: Validity of IL-5 level for discrimination between mild+moderate vs. severe psoriasis grades

	IL5
AUC	0.995
Cut-off (pg/mL)	46.8
Sensitivity (%)	100
Specificity (%)	94.7
PPV (%)	83.2
NPV (%)	100
Accuracy (%)	95.8

AUC, area under ROC, receiver operating curve; PPV=positive predictive value; NPV=negative predictive value.T

Table 7: Association of IL-5 level according to other parameters in the psoriasis group

	n	IL5			p
		median	Minimum	Maximum	
Sex					
Male	25	37.8	14.6	223	0.274
Female	25	33.15	15.7	167.9	
BMI					
Healthy weight	17	24.8	15.9	167.9	0.376
Overweight	22	35.85	14.6	223	
Obese	11	38.6	16.5	92.9	
FH					
Negative	40	34.9	14.6	223	0.219
Positive	10	42.5	20.5	185	
Koebner's phenomenon					
Negative	45	34.7	14.6	223	0.012
Positive	5	91.8	31.6	185	
Grades					
Mild	19	18.7	14.6	29.7	< 0.001
Moderate	19	38.6	31.3	50.8	
Severe	12	92.35	48.7	223	

Mann–Whitney test was used for comparison of IL-5 level between two groups; Kruskal–Wallis test was used for comparison of IL-5 level between more than two groups

or duration ($p > 0.05$ for each variable) (Table 8) (Fig. 7).

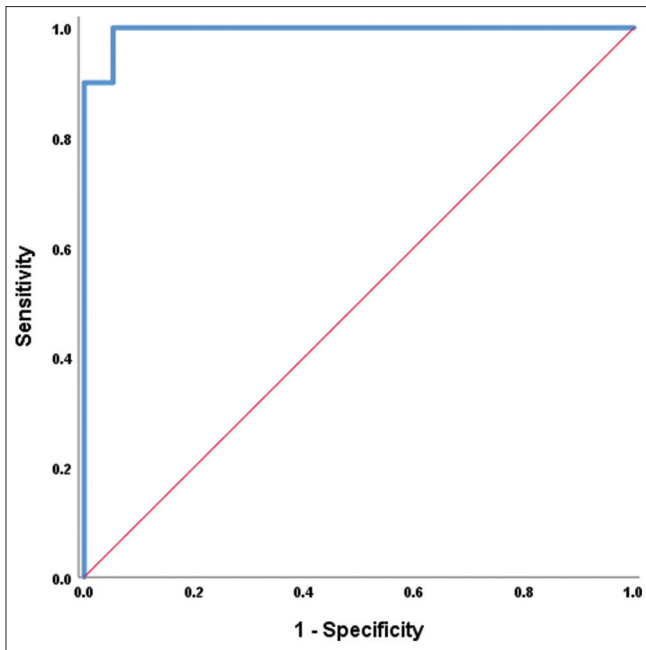


Figure 4: ROC curve of the IL-5 level for discrimination between low and high psoriasis grades.

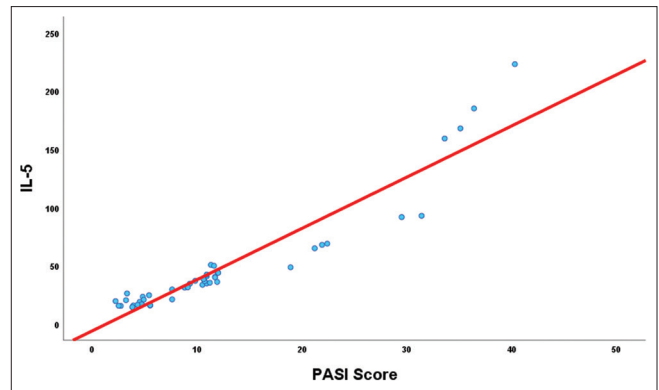


Figure 7: Correlation of IL-5 with the PASI score in the psoriasis group.

Table 8: Correlations of IL-5 level with age, BMI, onset, duration, and PASI score in the psoriasis group

	IL-5	
	rs	p
Age	0.187	0.204
BMI	0.142	0.336
Age at disease onset	-0.036	0.810
Disease duration	0.120	0.201
PASI score	0.943	< 0.001

rs, correlation coefficient

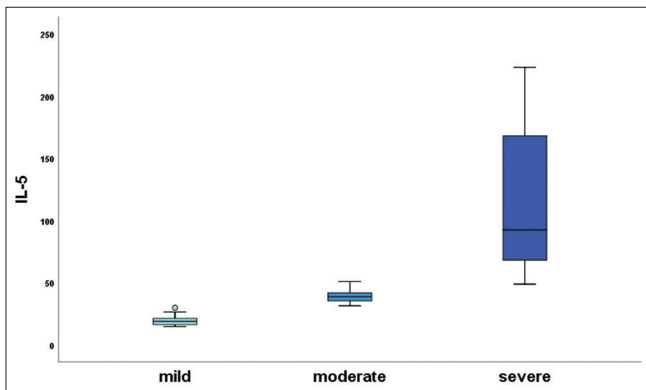


Figure 5: IL-5 level according to the severity grade.

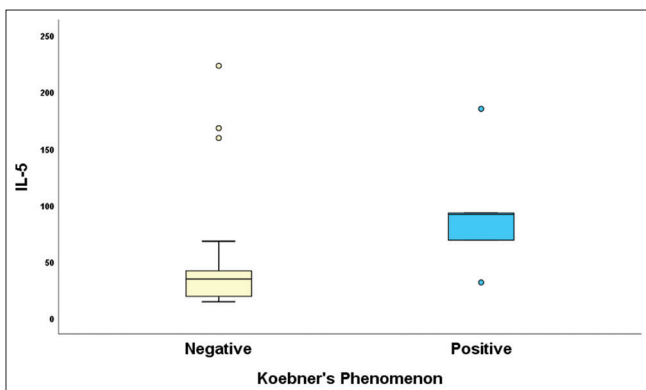


Figure 6: IL-5 level according to Koebner's phenomenon.

IL-5 Level as a Predictor

A logistic regression analysis was performed to forecast the progression of psoriasis, with age, sex, and IL-5

level serving as confounding variables. In univariable analysis, higher BMI and IL-5 levels were associated with psoriasis development. In multivariable analysis, however, only elevated IL-5 levels were regarded as independent predictors of psoriasis onset (Table 9).

A linear regression analysis was performed to predict the severity of psoriasis (as measured by a higher PASI score). Confounding variables included age, sex, BMI, FH, onset, duration, and IL-5 level. In univariable and multivariable analyses, a longer duration and a higher IL-5 level were regarded as independent predictors of psoriasis severity (Table 10).

DISCUSSION

Psoriasis is a prevalent chronic inflammatory disorder that impacts the joints and skin, impacting an estimated 2–3% of the global populace. Plaques that are well-defined, crimson, and scaly delineate skin lesions; they result from dermal angiogenesis, infiltration of T cells, dendritic cells, and monocytes, and increased keratinocyte proliferation [1].

As a result, psoriasis is presently recognized as a chronic condition characterized by recurrent inflammatory symptoms. Despite significant therapeutic advancements, the precise pathogenic mechanism that contributes to the development of psoriatic plaques

Table 9: Regression analysis for prediction of psoriasis susceptibility.

	Univariable			Multivariable		
	p	OR	95% CI	p	OR	95% CI
Age	0.129	1.019	0.995–1.044			
Sex	0.838	1.054	0.638–1.740			
BMI	0.001	1.127	1.052–1.208	0.892	0.986	0.805–1.208
IL-5	0.011	2.367	1.220–4.590	0.013	2.341	1.192–4.595

OR=odds ratio; CI=confidence interval. Logistic regression test was used.

Table 10: Regression analysis for prediction of factors affecting severity of psoriasis (higher PASI score).

	Univariable		Multivariable	
	β	P	β	p
Age	0.128	0.289		
Sex	4.867	0.174		
BMI	0.454	0.136		
Positive family history	-3.721	0.297		
Onset	-0.082	0.513		
Duration	1.118	< 0.001	0.208	0.031
IL-5	0.203	< 0.001	0.191	< 0.001

β = regression coefficient.

remains obscure; consequently, psoriasis persists as an incurable disease [9].

Cytokines, which are released from activated T lymphocytes, stimulate keratinocyte proliferation to initiate and maintain the psoriatic cycle [10]. Psoriasis has been hypothesized to be an inflammatory disease mediated by T helper (Th)17, with interleukin (IL)-17 mediating systemic inflammation [11].

Shilovskiy et al. [12] explain that interleukin 5 (IL-5) is a chemoattractant, differentiating, and expansion factor for eosinophils in relation to psoriasis. The severity of the disease does not appear to be influenced by interleukin 5, which is also referred to as eosinophil differentiation factor (EDF) and is a cytokine that regulates eosinophilopoiesis in a lineage-specific manner. It controls the activation and proliferation of eosinophils.

Conversely, Bonifati and Ameglio [13] identified IL-4, IL-5, and IL-10 as the prototypical cytokines of the Th-2 pattern in their systematic review. A discernible T-lymphocyte cytokine pattern in a lesional psoriatic epidermis is currently obscure. Indeed, certain authors have documented that psoriatic skin exhibits a Th-1 cell-mediated response; conversely, alternative research indicates the presence of a Th pattern or the existence of a distinctive pattern that is not Th-1 or Th-2 in nature. There have been conflicting reports regarding whether or not a lesional psoriatic epidermis produces an increase in both IL-4 and IL-5 production. Their

generation may originate from mast cells, which have also been implicated in this dermatosis.

The available data on the involvement of interleukin 5 (IL-5) in the pathogenesis and advancement of psoriasis is, to the best of our understanding, scarce and contradictory. Therefore, the purpose of this investigation was to assess the contribution of interleukin 5 to the pathogenesis of psoriasis.

Our investigation's objective was to determine whether or not there was a correlation between the severity of the disease and the concentrations of interleukin 5 in the serum of psoriasis patients.

From November 2020 to April 2021, this prospective case-control study was conducted at the Dermatology, Venereology, and Andrology Department of the Faculty of Medicine, Beni-Suef University, a tertiary care hospital. The study included a total of ninety participants, consisting of patients with mild, moderate, or severe plaque psoriasis as measured by the Psoriasis Area Severity Index (PASI) score and apparently healthy controls.

The analysis was conducted using the data of ninety participants, aged between 18 and 30, who were diagnosed with mild, moderate, or severe plaque of psoriasis. These participants were divided into two groups: the psoriasis group and the healthy control group.

The serum levels of IL-5 were significantly higher in the group of psoriasis patients ($p < 0.001$) than in the control group, according to the findings of our study.

Using immunochemistry, Letchumanan et al. [14] also discovered that the concentration of IL-5 in psoriatic lesions was greater than in control areas.

Bonifati and Ameglio [13] observed, in an additional systematic review, that the production of IL-5 is significantly increased in skin afflicted with psoriatic lesions as opposed to skin free of lesions or considered normal.

An additional investigation presented data indicating that eotaxin and IL-5 work in tandem to control the recruitment and activation of eosinophils in drug-induced maculopapular exanthems; this suggests that these two factors may play a crucial role in the development of psoriasis and other skin diseases [15].

However, the current study demonstrated that IL-5 levels are substantially higher in correlation with disease severity ($p < 0.001$), in contrast to previous research [13, 14] that suggests IL-5 levels do not appear to correlate with disease severity.

In relation to KP, Bornhovd et al. [16] corroborated our findings by demonstrating that patients who reported positive Koebner's phenomenon had elevated levels of IL-5 ($p = 0.012$) [17], in contrast to the healthy control group.

Consequently, our research raises the possibility that inhibiting IL-5 could be advantageous for psoriasis patients as a means of targeting cytokines.

In recent years, as technology has advanced, a number of studies have demonstrated the considerable effectiveness of anti-IL-5 agents in the treatment of specific diseases [18]. In light of the statistical significance of IL-5 presence among psoriasis patients, the outcomes of our research suggest that anti-IL-5 may have a beneficial therapeutic impact on dermatological conditions. Recently utilized humanized anti-IL-5 antibodies include benralizumab, relizumab, and mepolizumab [19].

Therefore, future clinical trials focusing on alternative cytokines or interleukins, either singly or in combination, may yield additional knowledge and tools for the treatment of psoriasis. Furthermore, the requirement for prolonged maintenance treatment continues to impose a substantial pharmacoeconomic burden. Modalities that may induce disease modification and long-term remission are still anticipated [20].

Strength Points of the Study

One of the primary strengths of this investigation is its prospective case-control design. Furthermore, this research represents the initial effort of any Middle Eastern university to examine the correlation between interleukin 5 serum levels and the severity of psoriasis vulgaris in patients with this condition.

Limitations of the Study

The limitations of the study are worthy of mention, including the relatively smaller sample size and that it was not a multicentric study. Another limitation is that the study did not assess the correlation with the patient's quality of life. Third was the presence of

COVID-19 pandemic, which limited the availability of patients.

CONCLUSION

The present study may burden the knowledge and shed some light on the possible role of IL-5 in the pathogenesis of psoriasis. Anti-IL-5 biologic therapies could be of value in managing psoriasis.

Statement of Human and Animal Rights

All the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the 2008 revision of the Declaration of Helsinki of 1975.

Statement of Informed Consent

Informed consent for participation in this study was obtained from all patients.

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