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Assessment of Interleukin-2 and Vitamin D Status in Vitiligo Patients Compared to Healthy

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ABSTRACT

Background: *Vitiligo is a chronic skin disorder characterized by the loss of pigment, resulting in white patches on the skin. This condition occurs due to the destruction or dysfunction of melanocytes, the cells responsible for producing melanin, pigment that gives skin its color.* ***Purpose:*** *To assess and compare the serum levels of interleukin-2 and vitamin D3 between patients with vitiligo and healthy individuals, in order to investigate their potential role in the pathogenesis of vitiligo.* ***Method:*** *Case-control study was conducted on 120 subjects, divided into two groups: the patient group included 60 individuals diagnosed with vitiligo, and the control group consisted of 60 healthy volunteers. Blood samples were collected from all participants after obtaining verbal consent. Serum level of interlukin-2 and vitamin D3 was measured using ELISA (Bet Lab/China).* ***Results****: In this study) I found that the mean level of interleukin-2 was significantly higher in vitiligo patient (0.66044±0.039136) compared to healthy controls (0.96919±0.125146) with a statistically significant difference (P- value =0.020) However the two clinical types of vitiligo the clinical types of vitiligo (localized and generalized), no statistically significant difference was observed. The mean level in localized vitiligo was (0.56941±0.032243) and in generalized vitiligo was (0.72113± 0.059873) (P-value =0.057), also This study, according linear scatter plot showed no statistically significant relationship between the duration of vitiligo and the level of IL-2. Vitamin D3 levels no statistically significantly between patients of vitiligo compared to controls, the mean levels (0.85717±0.041315) for patients with vitiligo, while the control (1.01195±0.115793), was (p-value= 0.211). Statistically significant difference was found between localized (075233±0.042477) and generalized (0.92706±0.060467) types of vitiligo (p-value =0.037).* ***Conclusion:*** *The study showed a significant increase in interleukin–2 levels among patients with vitiligo compared to healthy individuals, suggesting a possible role of this cytokine in the immunopathogenesis of the disease. However, IL-2 levels did not significantly differ between localized and generalized types of vitiligo, which may indicate that IL-2 is more related to disease onset rather than its clinical distribution.*

keyword: Interleukin–2, Vitamin D, and Vitiligo.

Article Information

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INTRODUCTION

Vitiligo is an acquired depigmentation condition resulting from the loss of functioning melanocyte in the epidermis [1]. Four theories have been posited to elucidate the pathogenesis of the disease. Theories include Autocytotoxic, Neural–humoral mechanisms, oxidant-antioxidant balance, and autoimmunity [2]. Several investigations have indicated that vitiligo is an autoimmune illness with CD4+ T cell having a key part in its etiology [3].

Interleukin–2 is secreted by activates T cell, it facilitates T cell proliferation and differentiation [4]. Role in Vitiligo activate cytotoxic T cell and natural killer cell, induces melanocye death during the initial phase of vitiligo[5]. Increased IL-2 level are associated with immunologically active vitiligo[6]. Vitamin D is a hormone produced in the skin. The active type of vitamin D, 125 dihydroxyvitamin D3, is a hormone that modulates calcium and bone metabolism,

regulates cell proliferation and differentiation, and performs immunoregulatory action [7]. The aetiology of diminished vitamin D3 level in individuals with autoimmune disorders remains unclear [8]. Vitamin D may influence both innate and adaptive immune response via receptors in Tand B-lymphocytes, macrophages, and dendritic cell[9]. Also vitamin D enhance tyrosine active and melanogenesis through a nuclear hormone the vitamin D receptor in melanocytes [10]. A significant body possess strong immunosuppressive properties, with reduced levels correlating with autoimmune disorders as Vitiligo [11].

METHODS

A case-control study was conducted in Najaf province, at Al-Najaf Teaching Hospital (Dermatology) Unit, between December 2024 and March 2025, after obtaining approval from the Research Ethics Committee at the College of Medicine, University of Kufa. The study included 120 participants, equally divided into two groups.

Patient groups: Consisted of 60 individuals clinically diagnosed with vitiligo by Dermatology specialists

Controls Groups: Consisted of 60 healthy individuals with no history of vitiligo or known autoimmune disorders. They were selected to match the patient group in terms of age and gender

Exclusion Criteria: (individual with) other autoimmune diseases, central nervous System disorders, immune deficiencies, malignancies, chronic infection, recent surgeries, or acute local infection or injures were excluded from the study laboratory and statistically procedures: All participants were informed about he study, objectives and provide verbal consent before sample collection. Blood samples were collected from all participants to analyze the following variables: Interleukin-2 and vitamin D: their levels were measured using the enzyme-linked immunosorbent assay ELISA technique from BetLab Data. The DATA analysis were performed using the SPSS software. Quantitative data were expressed as means and standard deviations (Mean+sd). The independent T-test was used to compare continuous variables between groups, while the chi-squared test was used for categorical variables. P-value less than 0.05 was considered statistically significant. Statistical analysis was conducted under the supervision of a biostatistics specialist to ensure the accuracy and reliability of the results.

RESULTS

Table 1 presents an analysis of Interleukin-2 (IL-2) levels in two clinical subgroups: localized cases(n=24) and generalized cases(n=36). The mean ±standard deviation (SD) of IL-2 levels was 0.56941±0.032243 in the localized group and 0.72113±0.059873 in the generalized group. Although the numerical difference suggests higher IL-2 levels in generalized cases, the p-value of 0.057 exceeds the conventional significance threshold ($p < 0.05$), indicating that this difference is not statistically significant (NS). Therefore, no conclusive evidence in supports a meaningful variation in IL-2 levels based on clinical pattern alone.

Table 1: comparison of IL-2 Levels Between Localized and Generalized cases.

Type	N	IL-2 mean ±SD	P-value=0.057	Significant \ NS
Localized	24	0.56941± 0.032243		
generalized	36	0.72113 ± 0.059873		

The table 2 evaluates IL-2 concentration in patients (n=60) compared to healthy controls(n=60). The IL2 level in patients was recorded at 0.66044± 0.039136, while controls exhibition a higher mean of 0.96919± 0.125146. Statistical analysis revealed a p-value of 0.020, which falls below the 0.05 threshold, confirming a statistically significant difference (S) between the groups, this result implies that disease status may be associated with a reduction in IL2.

Table 2: IL-2 Level in cases vs controls.

Type	N	IL-2 mean ±SD	p-value=0.020	Significant / S
Cases.	60	0.66044 ± 0.039136		
Control	60	0.96919± 0.125146		

The table 3 explores vitamin D3 levels in localized (n = 24) versus generalized cases (n =36) The localized group had a VD3 mean±SD of 0.75233± 0.042477, whereas the generalized group showed a higher level of 0.92706±0.060467. The P-value of 0.037 indicates a statistically significant difference between the groups. These findings suggest that the clinical type may influence serum VD3 levels, with generalized cases displaying elevated values compared to localized cases.

Table 3: comparison of VD3 levels between localized and generalized cases.

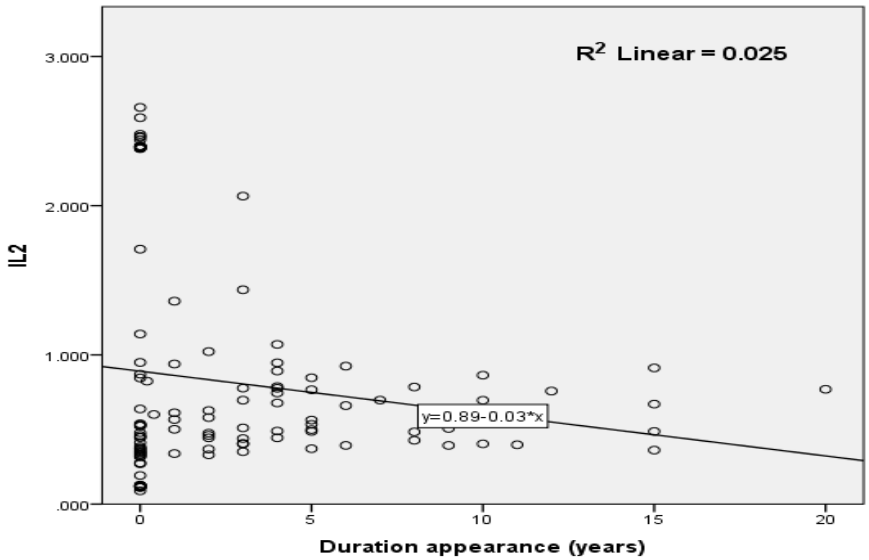
Type	N	VD3 mean ±SD	p-value=0.037	Significant/ S
Localized	24	0.75233 ± 0.042477		
generalized	36	0.92706± 0.060467		

The table 4 compares VD3 concentration in patients (n=60) and healthy controls (n=60). Patients had a mean VD3 level of 0.85717± 0.041315, while controls recorded a higher mean of 1.011195± 0.115793. However, the observed P-value of 0.211 is greater than the accepted level of significance, indicating no statistically significant difference between the two groups. Therefore, the variation in VD3 levels is likely not attributable to disease status alone.

Table 4: VD3Levels cases vs controls.

Type	N	VD3 mean ±SD	p-value=0.211	Significant/ NS
Cases	60	0.85717± 0.041315		
Control	60	1.01195 ± 0.115793		

The linear scatter plot (1), shows R2 linear = 0.025 and r= 0.158 there is a negative linear or weak correlation (less than 0.4) between IL2 and duration of appearance per years for vitillago patients due to r is close to 0.



Scatter plot (1): correlation between IL2 (y=0.89) and Duration appearance (x=0.03) from patients with vilaligo.

DISCUSSION

Study the relation interleukin-2 between patients with vitiligo and controls.

In current study we found significant statistically between patient with vitiligio and healthy control, was IL-2 (P value =0.020) this result agree with many studies by [12] and [6] these found higher level IL-2 with patient group compare with health group, that respectively with our study Elevated of interleukin -2 in vitiligo patient compare to health control suggest a active Immune response to the disease pathogenesis throuth T cell attack melanocyte in the skin this reflects an abnormal immune response that may contribute to progression of the disease.

Study level of interleukin-2 with localized and generalized

Also, we found in our study no significant between level IL-2 in local vitiligo and generalized vitiligo (P value =0.057) this result contrast with study by [6].

Indicate higher level IL-2 in the local vitiligo compared with generalized vitiligo. The lack of significant difference between localized and generalized vitiligo may reflect similar immune mechanisms in both types, the influence other cytokines in determining the clinical pattern and individual variation among patients.

Association of Interleukin-2 with duration of disease vitiligo

The current study illustrates the relationship between IL-2 levels and the duration of vitiligo disease in patient. The graph shows that the coefficient of determination (R2= 0.025) is very low, indicating that the duration of disease explains only 2.5% of the variation in IL-2 levels. The correlation coefficient (r= 0.258) also shows a very weak inverse relationship between the two variables, with the value of being less than 0.4, indicating the absence of a strong or statistically significant correlation. The linear

regression equation (y= 0.89) shows a slight trend toward decreasing IL-2 levels with increasing duration of disease. However, this slope in insufficient to confirm a causal or significant relationship between the two variables. This result corresponds other studies also by [12]. Also by [6] shows a negative correlation of interleukin-2 with duration of disease, that may indicate the immune response in vitiligo patients, include interleukin-2 , dose not change significantly overtime this may be due to the stability of the underling immune mechanism of vitiligo and insensitivity to timescales. addionaly, environmental, genetic influential of the immune response timescales.

Study vitamin D3 in patients vitiligo and control

This study no statistically significant between patient with vitiligo and control, was p -value (0.211), which contrasts to some previous studies that showed an association between vitamin D deficiency and vitiligo progression. In the study by [13] that examined vitamin D level in vitiligo patients, the researcher found that patients with vitiligo showed significantly lower levels of vitamin D compared to health controls, Highlighting the potential relationship between vitamin D deficiency and disease progression. These finding have been supported by other studies, like [14], all of which showed an associated between low vitamin D levels and the condition of vitiligo patients. In present study is consistent with some studies that did not significant difference between patients and healthy controls, for example, the study by [15]. Appearance no difference in vitamin D levels between the two groups, which is consisting with our results. This discrepancy between studies may be attributed to several factors, including differences in the vitiligo is not caused by a single factors but from result a combination of genetic, Immune environmental, and hormonal factors, even if d influences some of these factors, it is not the sole or primary causes of the disease. Study correlation between level of vitamin D with types of vitiligo localized and generalized By present study found elevated level Vitamin D in generalized vitiligo compare localized, significant statistically(p value = 0.037) the higher vitamin D level in patients generalized vitiligo compared to localized vitiligo may be due to they used of nutritional supplement, it may also have a potential role in immune regulation linked to disease severity. the result contrasts with a study by [16] found not difference between types of vitiligo in level vitamin D not statistically significant (p value-0.81).

CONCLUSION

Based on the findings of this study statistically significant difference In IL-2 levels was observed between vitiligo patients and healthy Individuals, with no significant difference between localized and generalized types of vitiligo. Similarly, no significant difference In vitamin D3 levels was found between patients and controls, however, a significant difference was noted between the localized and generalized from these result suggest a potential role of lL-2 in the pathogenesis of vitiligo and indicate that vitamin D3 levels may be associated with the extent of disease involvement rather than occurs

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Ethical approval

The study received formal approval from the Ethics Committee of the Faculty of Medicine, University of Kufa, prior to its initiation. Written informed consent was obtained from all participants, and official authorization for conducting the research was granted by the Dermatology unit.

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