Original Article

Serum Resistin, Vitamin D, and Vitamin E levels in Patients with Mild and Moderate Psoriasis

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Abstract

Background: One inflammatory, persistent skin condition is psoriasis. Dietary, environmental, genetic, oxidative stress, and immune variables all contribute to the pathophysiology of psoriasis. Resistin, an adipokine, as well as vitamin E (VE) and vitamin D (VD), has been shown to correlate with the pathogenesis of psoriasis. **Objective:** This study aimed to evaluate the level of resistin in psoriasis patients and its relation with body mass index (BMI), VE and VD, and the severity of the disease. **Methods:** A case-control study was conducted on 90 participants; 30 healthy subjects and 60 psoriasis patients of mild and moderate severity (30 patients in each group). Serum levels of resistin, VE and VD were measured in the three groups. **Results:** Serum levels of resistin were found significantly higher in the moderate psoriasis group (3.01 ± 0.3 ng/mL) than in the mild psoriasis group (2.07±0.2 ng/mL) and healthy control (1.3 ± 0.27 ng/mL) ($p < 0.001$). Levels of VE and VD were found lower in the moderate psoriasis group (3.3 ± 1.4 µg/mL and 14.0 ± 3.1 ng/mL, respectively) than in the mild psoriasis group (7.15 ± 0.5 µg/mL and 16.8 ± 2.8 ng/mL, respectively) and the control group (19.3 ± 1.3 µg/mL and 25.0 ± 1.8 ng/mL, respectively) ($p < 0.001$). A significant positive correlation ($r = 0.65$, p value = 0.04*) was reported between serum resistin levels and BMI in moderate psoriasis compared with mild and control groups. Conversely, a significant and slight non-significant negative correlation was obtained between serum resistin levels with VD and VE ($r = -0.49$, p value = 0.05; $r = -0.34$, p value = 0.3, respectively) in the same groups. **Conclusion:** The results of this study indicated that resistin plays a major part in the pathophysiology of psoriasis and may lead to the development of potential novel diagnostic or therapeutic approaches. Blood levels of resistin may be significantly influenced by VD and body mass index.

Keywords: Psoriasis, Resistin, Adipokine, Vitamin E, Vitamin D.

Introduction

A common autoimmune chronic inflammatory skin disorder that affects 2-4% of the general population is psoriasis.[1] It is characterised by aberrant proliferation of keratinocytes, or epidermal cells, which causes psoriatic plaques to form.[2] Disease severity ranges from red, scaly plaques in a few places to huge involvement of the whole body surface. Psoriasis patients are physically and psychologically affected because of the disease and the need for a life-long medication. Most often, psoriasis starts at the age of 15 to 40 years and rarely before that. The disease fluctuates between remission and exacerbation with chronic tendency. Atherosclerosis and cardiovascular events are common comorbidities associated with psoriasis.[3,4]

Although the exact cause of psoriasis is unknown, genetic, immunological, and environmental factors—including diet—are thought to have a role. Psoriasis is pathologically linked to a rise in proinflammatory cytokine production, which propels the disease's progression. They result in hyperproliferation of epidermal keratinocytes, abnormalities in differentiation, and an overabundance of pro-inflammatory mediators.[5]

White adipose tissue secretes adipokines, which are cell-signalling substances that exist under the skin (subcutaneous fat) and surrounding internal organs (visceral fat). Moreover, other immune cells—macrophages

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in particular—also contribute to the production of adipokines. Adipocyte-derived secreted factor (ADSF), another name for resistin, is a proinflammatory adipokine linked to inflammation, immunology, obesity, and insulin resistance. Monocytes and macrophages found in adipose tissue and peripheral blood arteries are the main producers of human resistin. The molecular mechanism behind the correlation between resistin and psoriasis remains poorly understood; however, proinflammatory adipokines, including resistin, may be stimulated by the elevated production of proinflammatory mediators (TNF-α, IL-6), which are known to be present in psoriasis.[6,7]

Most research now available focuses on the immunomodulatory functions of adipokines, which may either promote or improve psoriasis.[8] Another significant factor in the pathogenesis of psoriasis is oxidative stress. Psoriasis-related redox imbalances have been found in skin cells, blood and plasma cells, and, more recently, saliva. The development of atherosclerotic plaque may be facilitated by oxidative stress. Damage from reactive oxygen species to vascular endothelial cells increases the permeability of tiny blood vessels, which in turn permits the spread of inflammatory cells and exacerbates the inflammatory process associated with psoriasis.[9,10]

Antioxidants are compounds that, through various chemical processes, guard against the damaging effects of free radicals. These include flavonoids, vitamin A, vitamin C, vitamin E, and beta-carotene. Adipokines play a role in oxidative stress.[11] The first evidence of the presence of vitamin D receptors in keratinocytes came from in vitro research of cultured keratinocytes in 1988. Numerous subsequent in vitro and clinical investigations have thoroughly shown the function of vitamin D in keratinocyte proliferation and differentiation.[12]

One potential adjuvant therapy for psoriasis medications is the control of the local neuroendocrine system through the stimulation of anti-inflammatory and downregulation of pro-inflammatory messengers. Skin function and preservation of skin homeostasis depend on vitamin D receptors and vitamin D-mediated signalling pathways. Even at high dosages, the active forms of vitamin D function as potent immunomodulators of clinical response in psoriatic patients and are the safe, efficient adjuvant therapy for psoriasis.[13]

As a result, some research suggested that resistin levels in the serum may be useful in predicting the existence of psoriasis,[14-17] while other investigations produced inconsistent findings. Considering the limited information available on vitamin D and vitamin E levels in individuals with mild to moderate psoriasis.[18,19] In light of the aforementioned findings, the current study was conducted to evaluate the serum resistin, vitamin D, and vitamin E levels in psoriatic patients compared to controls and examined the relation of vitamin E&D status and BMI with adipokine represented by resistin.

Patients and Methods

Subjects

This case-control study included 90 individuals (controls and psoriatic patients of both genders) aged between 5 and 50 years. Patients with psoriasis were diagnosed by specialist dermatologists attending the outpatient consultation clinic in Mosul, Iraq, conducted between April and November 2023.

The control group (Group A) consisted of thirty individuals. Following examinations by clinic advisors, every member of the control group looked healthy, had no chronic illnesses, was not taking any medicine regularly, and matched the patient group's age and BMI. Sixty people with psoriatic patients comprised the patients' group (Group B), subdivided according to their PASI score into two groups of thirty patients each. Accordingly, the 60 patients were grouped into the mild psoriasis group (PASI score (<7), n = 30) and the moderate psoriasis group (PASI score between (7-15), n = 30).

Patients with malignancy, autoimmune diseases, pregnancy, and immunocompromised states (HIV infection); patients taking corticosteroids, antioxidants, systemic insulin, and thiazolidinedione (TZD) during the four weeks before the study; patients with other chronic metabolic diseases (diabetes mellitus, coronary heart disease, chronic kidney disease, and hepatic cirrhosis); and smokers were excluded. A full family and personal history were taken from the included patients, who were also subjected to clinical examination by the specialist physician in addition to laboratory investigation. The Psoriasis Area Severity Index score was determined following the PASI scoring system for each patient.[20] The participant's body mass index was calculated by dividing their weight in kilograms by their square height in meters.[21]

Clinical Laboratory Investigation

Fmilliliterstres of blood samples were obtained from a vein of all participants using a disposable syringe. The blood was put into a plain tube and allowed to clot at room temperature, then the serum was separated by centrifugation at 3,000 rpm for 10 minutes. This serum was then divided into three portions in Eppendorf tubes and next frozen at -20°C until measurement. Serum resistin was measured using a human RETN (resistin) ELISA kit (Elabscience®, USA) following the manufacturer's instructions. Sandwich-ELISA is used as the kit method. Optical density was measured using an ELISA reader (BIO-TEK, USA) at 450 nm as the primary wavelength. The assay sensitivity was 0.0187 ng/ml.

Serum vitamin E level was detected using a vitamin E assay kit (Elabscience®, USA), which is a colorimetric assay. The optical density of the resultant solution was measured at 533 nm while the sensitivity of the kit was 0.09 µg/mL.

Vitamin D serum concentration was measured using the Elecsys Vitamin D Total III (cobas®e 411) autoanalyzer (Roche, Germany). Vitamin D concentration was calculated from the calibration curve produced. The measuring range of the kit was 3.00-120 ng/mL.

Statistical Analysis

Statistical analysis was performed using SPSS software (version 20.0). Categorical variables were presented as a percentage, while quantitative data were expressed using mean ± standard deviation (SD). One-way ANOVA was used for multiple comparisons, and Pearson's correlation was used to assess the statistical correlation between the study parameters. Significance was set at a p-value of less than 0.05 by both one-way ANOVA and Pearson's correlation.

Results

The results of the demographic characteristics of the study population were summarised in (Table 1). ninety participants were included in this study, of which 30 were healthy and 60 had psoriasis. The mean age was 27.75 ± 18.4 years for the control group, 27.3 ± 18.7 years for the mild psoriasis group, and 21.16 ± 18.8 years for the moderate psoriasis groups, which were not statistically significant. The majority of the mild psoriasis group was male (90%), while only 10% of the moderate group was male; the difference was statistically significant. No significant difference was found among the three groups concerning BMI to exclude these factors' possible effects on the parameters under investigation. Moreover, 90% of the mild psoriasis group had a positive family history of psoriasis, while 50% of the moderate group members had a positive family tendency.

Table 1: Statistical Comparison of the Demographic Data of the Case and Control Groups.

Parameters	Control n=30	Mild Psoriasis n=30	Moderate Psoriasis n=30	*p* value
Age (years) (Mean ± SD)	27.75 ± 18.4	27.3±18.7	21.16 ± 18.8	NS
Sex n (%)				
Male	18 (60%)	27 (90%)	3 (10%)	0.001
Female	12 (40%)	3 (10%)	27 (90%)	0.001
BMI (kg/m^2) (Mean ± SD)	29.7 ± 5.7	29.27 ± 9.3	30.3 ± 8.3	NS
Family history n (%)				
Positive	-	27 (90%)	15 (50%)	-
Negative		3 (10%)	15 (50%)	

NS; nonsignificant, BMI; body mass index, n; number, one-way ANOVA used for three groups comparison and χ^2 -test for two groups comparison."

Adipose tissue has important endocrine functions of secreting adipokines and numerous cytokines.[22] Adipokines have drawn more attention in the past several years, especially because of their involvement in autoimmune diseases. It has been shown that the action of adipokines can be multidirectional; they can both exacerbate the development of some diseases as well as inhibit others.[23,24]

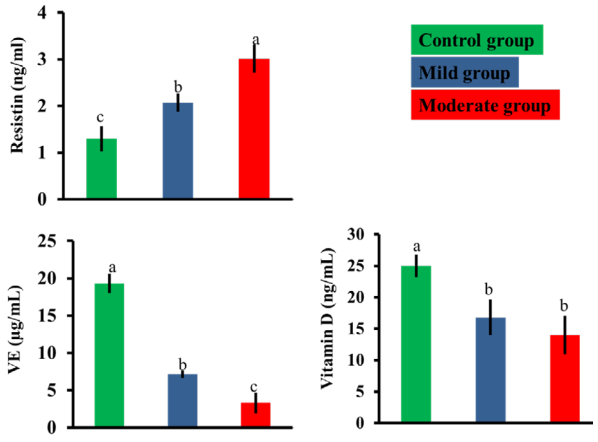

Figure 1: Resistin, Vit. E and Vit. D levels among Studied Groups. Means Followed by Different Letters are Significantly Different According to Duncan's Multiple Range Comparisons (DMRTs). Means Followed by the same Letter are not Significantly Different. p value < 0.001 (***) by One-way ANOVA. Vit.: Vitamin, Mild: Mild Psoriasis Group, Moderate: Moderate Psoriasis Group.

This case-control study aims to assess whether serum resistin levels and their correlation with vitamins D & E can be used to gain further insight into the intricate pathophysiology of psoriasis associated with adipokines, which may lead to the development of innovative diagnostic or treatment approaches.

The results in (Figure 1) summarize the statistical comparison of the mean values of resistin, Vit. E and Vit. D among the three tested groups (control, mild and moderate psoriasis). In the current study, there was a significant difference (p-value < 0.001) in the mean values of serum resistin among the three groups, with the highest serum level (3.01 ± 0.3 ng/mL) observed for the moderate psoriasis group and a lower level (2.07 ± 0.2 ng/mL) for the mild psoriasis group and the lowest record for the control group (1.3 ± 0.27 ng/mL). Resistin affects many different types of cells and tissues and functions through paracrine, autocrine, and endocrine pathways.[25] TNF and IL-6 are examples of pro-inflammatory cytokines that are linked to circulating resistance. This protein has been shown to have signaling action in a variety of cell types, including vascular cells, peripheral blood mononuclear cells (PBMCs), and macrophages. However, it is thought that PBMCs have the biggest impact on serum resistin levels.[26] Notably, recent research has shown that keratinocytes and sebaceous glands may also express human resistance.[27] Pro-inflammatory cytokines and hyperproliferation of keratinocytes are two features of psoriasis, a chronic skin disorder mediated by the immune system. The major

cell subtypes implicated in the progression of psoriasis are dendritic cells, T lymphocytes, and keratinocytes; the interleukin-23 (IL-23)/IL-17 pathway accelerates the disease's progress.[8] Previous studies suggest that resistin may increase inflammation, exacerbating the symptoms of psoriasis,[28-30] while its production increases in response to proinflammatory factors.[31]

These findings supported other research that had been published and showed how pro-inflammatory mediators can raise the expression of resistin, such as LPS, TNF-α, IL-1β, and IL-6, in PBMCs.[32-34] As well as a recent study by Słuczanowska et hat showed that elevated levels of plasma resistin are seen in psoriasis patients.[35] It's interesting to note that research on resistin's function in the pathophysiology of psoriasis has recently begun. According to Johnston et al., resistin and psoriasis severity have a positive association.[36,37] In accordance, our study reported a significantly higher resistin level in the sera of psoriasis patients in comparison to the healthy control and the moderate psoriasis group in comparison to the mild psoriasis group, improving the potential role of resistin in the diagnosis of the disease and in evaluating disease severity.[38,39]

Furthermore, there was a highly significant difference obtained among the three groups (p-value < 0.001) concerning Vit. E; the highest serum level of Vit. E was observed for the healthy control subjects (19.3 ± 1.3 µg/mL, mean ± SD) followed by the mild psoriasis group (7.15 ± 0.5 µg/mL) and the moderate psoriasis group (3.3 ± 1.4 µg/mL) (Figure 1). Skin health and the aging process have long been correlated to vitamin E, justifying its inclusion in many cosmetic formulations. Serum levels of vitamin E have also been shown to correlate with inflammatory skin diseases. A recent meta-analysis conducted in 2021 reported lower levels of Vit. E in patients with several skin diseases, including psoriasis.[40] The same study suggested the need to assess Vit. E levels as a means to improve the clinical status of the affected patients. Our study found that Vit. E levels in the healthy control group were significantly higher than those in the two psoriasis groups, and the levels went even lower in moderate than mild psoriasis patients. This finding strongly suggests the role of Vit. E in disease initiation and severity. Vit. E, via its antioxidant activity, was shown to reduce collagen deposition and inflammation and consequently result in metabolic improvement in obesity. With no studies revealing serum levels of vitamin E in mild and moderate psoriasis.[41]

Similar to Vit. E, serum levels of Vit. D was (25.0 ± 1.8 ng/mL) for the control group and significantly higher than those of the mild and moderate psoriasis groups (pp-value< 0.001). However, the serum level of Vit. D was found statistically non-significant between the two disease groups (16.8 ± 2.8 ng/mL and 14.0 ± 3.1 ng/mL for the mild and moderate psoriasis groups, respectively). The findings of this investigation agree with those of other clinical investigations. Serum vitamin D levels are much lower in psoriatic patients than in healthy control participants, according to case-control research conducted in 2022. Serum vitamin D deficiency was negatively correlated with PASI score and the severity of the condition.43 Similar results were also presented in other studies by Tajjour *et al.*[42], Orgaz-Molina *et al.*[43], and Chandrashekar *et al.*[44]. Vitamin D plays a role in the pathogenesis of a variety of skin diseases, psoriasis for instance. Several systematic observations reported a significant link between low Vit. D levels and psoriasis and evidenced its involvement in immune and inflammation modulation.[45-47] Richetta *et al.*[48] reported a decreased Vit. D receptor mRNA expression, and polymorphism of the Vit. D receptor gene is allied with increased psoriasis risk.[48] Studies have demonstrated an anti-inflammatory effect of Vit. D causes downregulation of several proinflammatory cytokines such as tumor necrosis factor-α, interleukin-1β, interleukin-6, and interleukin-8.[49-52]

Vitamin D promotes keratinocyte differentiation and suppresses keratinocyte proliferation. As a result of these two significant discoveries about vitamin D in keratinocytes, the pathophysiology of psoriasis has been linked to vitamin D; D; that is, a reduction in vitamin D leads to an increase in keratinocyte proliferation and cutaneous inflammation. This observation points to the role of Vit. D in psoriasis and its potential role in improving patients' disease course.[53]

The correlation between resistin serum levels and BMI, Vit. E, and Vit. D in the three groups was also studied using Pearson's correlation as shown in (Table 2).

Table 2: The Correlation Coefficient between Serum Resistin and each of BMI, Vit. E and Vit. D.

Parameter	Control	Mild Psoriasis	Moderate Psoriasis
BMI	$r = 0.40$, p value = 0.07	$r = 0.50$, p value = 0.1	$r = 0.65$, p value = 0.04*
Vit. E	$r = 0.08$, p value = 0.7	$r = -0.35$, p value = 0.3	$r = -0.34$, p value = 0.3
Vit. D	$r = 0.07$, p value = 0.7	$r = -0.38$, p value = 0.27	$r = -0.49$, p value =0.05*

r: Pearson's correlation coefficient, *$p \leq 0.05$: statistically significant, BMI: Body Mass Index, Vit E: Vitamin E, Vit D: Vitamin D"

A positive correlation was observed between serum resistin level and BMI in the three study groups; except in the moderate psoriasis group, it was significant (p-value = 0.04). Obesity has recently been proposed as one of the variables influencing psoriatic events; the correlation revealed that psoriasis sufferers are more likely to be obese than the general population. Endocrine and pro-inflammatory substances stored in adipose tissue overwhelm the body's homeostasis and cause systemic dysregulation in several organs.[53]

In addition, because white adipose tissue is an important endocrine organ that secretes a variety of immunological

mediators as well as inflammatory and metabolic components with pro-inflammatory activity, there may be a relationship between this autoimmune illness and obesity. Therefore, immunologically mediated pathways are common contributors to both obesity and psoriasis.[54] Many studies have reported a tendency for overweight individuals to develop psoriasis[55,56] and that a low-calorie diet is associated with an improvement in a patient's clinical status.[57,58] Johnston *et al*.[36] suggested the involvement of resistin in the pathogenesis of obese patients with psoriasis via enhancing cytokine expression. Along the same lines, our study found a positive correlation between resistin serum levels and BMI.

A negative non-significant correlation was noticed between serum resistin levels and Vit. E in the mild and moderate psoriasis groups (r = -0.35 and -0.34, respectively) but very weakly positive in the control group (r = 0.08). Furthermore, a negative significant correlation between resistin serum level and Vit. D was noticed in the moderate psoriasis group (r = -0.49, p-value = 0.05), while negative non-significant in the mild group (r = -0.38, p-value = 0.27) and very weak positive in the control group (r = 0.07, p-value = 0.7). With no studies revealing the relationship between resistin and vitamin E in psoriatic patients. On the other hand, concerning vitamin D levels, we also found that both mild and moderate psoriasis groups showed a positive correlation with resistin; this might be due to vitamin D affecting inflammatory responses in adipose tissue by influencing the production and function of adipokines.[59,60]

Conclusion

Lastly, considering the outcome, T serum resistin level may be utilized as a diagnostic biomarker to assess the clinical status of psoriasis patients, and this may lead to further insight into the intricate pathophysiology of adipokines-associated psoriasis and may lead to the development of potential novel diagnostic or therapeutic approaches. Furthermore, serum levels of vitamins E and D should be measured and adjusted routinely in psoriasis patients due to their involvement in disease pathogenicity. Blood levels of resistance may be significantly influenced by vitamin D and body mass index.

Statement of Ethics

The Collegiate Committee for Medical Research Ethics / University of Mosul provided ethical approval to perform the study. (10.4.2023-No. 7/15/3186).

Conflict of Interest Statement

The authors declare no conflict of interest.

Author Contributions

Concept: M.H.M., J.A.M.. Design the research study: J.A.M., M.H.M. Data Collection and Analysis: M.H.M., J.A.M Interpretation: M.H.M., J.A.M.:Literature Search: J.A.M., M.H.M., S.H.I.:Writing: J.A.M., M.H.M., S.H.I. Examination of Patients S.H.I. All authors contributed to the revision and approval of the final manuscript.

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