Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2023.226919.2838 Volume 30, Issue 8.1, NOV. 2024, Supplement Issue
Manuscript id: ZUMJ-2308-2838
Doi: 10.21608/ZUMJ.2023.226919.2838

ORIGINAL ARTICLE

Evaluation of Serum Levels of Adiponectin and Myonectin in Psoriasis Vulgaris Patients with and Without Metabolic Syndrome

Ahmed Hesham Edrees [1*], Abdalla Hasan Kandil [2], Elsayed Mohammed Galal Khater [2], Ahmed Mohammed Baraka [3]

[1] Dermatology Resident at AlAhrar Teaching Hospital, Zagazig
[2] Dermatology, Venereology, and Andrology Department, Faculty of Medicine, Zagazig University
[3] Clinial Pathology Department, Faculty of Medicine, Zagazig University

Corresponding author*: Ahmed Hesham Edrees

Email: a.heshamed@gmail.com

Submit date: 03-08-2023
Revise date: 27-08-2023
Accept date: 29-08-2023

ABSTRACT

Background: Psoriasis is a persistent, inflammatory, and proliferative skin disorder. It is distinguished by erythematous plaques coated with silvery scales.**Objectives:** Highlight the role of adiponectin and myonectin in psoriasis and metabolic syndrome (MetS) patients. **Methods:** This case-control study included 45 cases with different types of psoriasis vulgaris, diagnosed based on typical clinical features, of which 15 cases have metabolic syndrome in addition to psoriasis and another 15 patients have psoriasis without metabolic syndrome. PASI and MSSS were assessed, as well as adiponectin and myonectin, and their association was evaluated. **Results:** There was significant variation between the groups respecting clinical and laboratory data, metabolic syndrome severity score (MSSS), adiponectin, and myonectin ($p<0.05$). Adiponectin and myonectin were significantly lower in psoriasis with the metabolic group than in psoriasis without the metabolic group. Both groups had significantly lower adiponectin and amyonectin levels than the control group. **Conclusion:** Psoriasis cases are susceptible to dyslipidemia and the basic elements of the metabolic syndrome. This emphasizes the importance of screening all psoriasis cases for related MetS to detect it early and treat it to lower morbidity and mortality. Adiponectin and myonectin levels were remarkably elevated in the control group than in psoriasis patients. Adiponectin and myonectin levels were much elevated in the control group than in psoriasis patients. Regarding psoriasis patients, both were lower in metabolic syndrome patients than those who are free of it. Measuring their levels can serve as a measurement for progression of both psoriasis and MetS.

Keywords: Adiponectin; Myonectin; Psoriasis Vulgaris

INTRODUCTION

Psoriasis is a chronic disease that is caused by a polygenic predisposition as well as triggering environmental stimuli like trauma, infection, and medication. Psoriasis appears clinically as plaques and erythematous scaly papules, with pustular lesions and erythroderma. The scalp, trunk, hands, nails, elbows, knees, and feet are the most commonly involved areas. 10% to 25% of patients have psoriatic arthritis. Psoriasis is marked pathologically by consistent rete ridges elongation, intermittent parakeraosis, vascular dilation, and suprapapillary plate thinning. Occasionally, neutrophils and lymphocytes infiltrate the perivascular dermis and epidermis in aggregates [1]. Psoriasis is recognized to have a negative impact on the quality of life of patients. While the investigation is sparse and results are unstandardized, current evaluations show that all psoriatic patches and plaques reduce cases' quality of life, with no region doing so to a considerably higher incidence than another [2].

The prevalence of metabolic syndrome (MetS) in psoriasis cases has a notable range (20-

50%), and psoriatic cases have at least double the chance of developing MetS compared to nonpsoriatic control. Cases with severe psoriasis are also more likely to have MetS than those with moderate skin conditions. Recent data points to shared genetic predisposition, several metabolic risk factors, and pathogenic pathways between psoriasis and MetS [3].

Different metabolic pathways are mediated by adiponectin. Adiponectin levels in the blood are elevated, which enhances lipid and glucose metabolism and reduces inflammation and oxidative stress. Adiponectin elevation lowers the likelihood of developing metabolic syndrome. Adiponectin needs to be taken into account as a possible treatment target for metabolic syndrome [4].

Myonectin is a myokin induced by exercise protecting the heart from acute myocardial ischemia injury by regulating inflammation and apoptosis. MetS raises the risk of a heart attack. [5].

Exercise training can be extremely important in reducing obesity-associated disorders and MetS; this impact is somewhat related to myonectin activities given the involvement of myonectin in enhancing fatty acid intake. As a result, it is advised to adopt this form of exercise to lower the risk of diseases linked to MetS and obesity [6].

The study is designed to highlight the role of adiponectin and myonectin in psoriasis and metabolic syndrome patients

METHODS

This case-control study included 45 patients with different types of psoriasis vulgaris, diagnosed based on typical clinical features, of which 15 patients have metabolic syndrome in addition to psoriasis and another 15 patients have psoriasis without metabolic syndrome, these were assigned into 2 separate groups. 15 health, sex, and age-matched persons were included as the control group. The study was carried out at the Dermatology and Venereology Department outpatient clinic, Zagazig University Hospitals, and Al-Ahrar Teaching Hospital in Zagazig. Adiponectin and Myonectin analysis by ELISA were held in Clinical Pathology Department Labs. This study had the approval of the Institutional Review Board (IRB) (#9818/26-9-2022). Written informed consent to participate in the study was obtained from all participants. Sample collection took place from 12/12/2022 until 13/3/2023.

Psoriatic patients (both genders) over 18 years of age with different types of psoriasis vulgaris were included in our study.

Cases with the following characteristics were excluded; cases on metformin, thiazolidinedione rimonabant anorexic antiobesity drug, and statins. Patients with other dermatoses, inflammatory bowel disease, rheumatoid arthritis, heart and kidney failure, and Lung disease.

Written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

All patients and controls were subjected to the following assessments before collecting the blood samples; complete history taking, general examination, and clinical assessment. In addition, dermatological examination of psoriatic patients including the degree of scaling, erythema, and induration as well as examination of the scalp and nails. Furthermore, the calculation of Psoriasis Area and Severity Index (PASI) scores to determine the severity of psoriasis.

PASI score

PASI score is a tool used to measure the severity and extent of psoriasis. For each body part, a sample area of psoriasis is chosen: head 10% surface area, arms 20% surface area, trunk 30% surface area, and legs 40% surface area. A scale from 1 – 10 is a case of mild psoriasis, 11 – 20 for moderate psoriasis and > 20 is severe psoriasis [7].

Lipid profile assessment

Total cholesterol, triglycerides, and HDL-cholesterol levels were assessed by a colorimetric method [8]. LDL-cholesterol values were assessed according to Friedwald's formula [9]. Blood glucose was done by enzymatic determination by coupled reaction [10]. Diagnosing MetS based on the criteria mentioned above.

MetS severity score

Utilizing the MetS severity score created by West Virginia University's Public Health Department of Biostatistics, the severity of MetS was calculated [11].

Adiponectin and myonectin

The plasma concentrations of adiponectin and myonectin in each sample were assessed using ELISA concerning the manufacturer’s procedure.

STATISTICAL ANALYSIS

The data were analyzed using IBM SPSS 23 (SPSS Inc., Chicago, IL, USA) and NCSS 11 for Windows

(NCSS LCC., Kaysville, UT, USA). Quantitative data were presented as mean, standard deviation, and range, whilst categorical data were presented as numbers and percentages. Category-specific factors were analyzed using the Chi-Square Test (X2). Assuming normality at P>0.05, quantitative data were examined for normality by the Kolmogorov-Smirnov test. If normality was found, either the ANOVA (F) test or the Kruskal-Wallis test was used to compare three means. Results with a P value < 0.05 are significant.

RESULTS

This case-control study included 45 subjects; 30 psoriasis patients of which 15 have metabolic syndrome in addition to psoriasis and another 15 patients who don't have metabolic syndrome. 15 normal subjects served as controls, and the demographic and anthropometric data are shown in Table (1).

Psoriatic patients were subdivided according to PASI score. The score ranged from 0-72. Patients with PASI<10 were 10 (33%) (3 with metabolic syndrome and 7 without it) represent mild psoriasis; patients with PASI (10-20) were 15 (50%) (9 with metabolic syndrome and 6 without it) represent moderate psoriasis while patients with PASI > 30 were 5 (27%) (3 with metabolic syndrome and 2 without it) represent severe psoriasis (Table 2).

PASI score ranged from 7.6 to 42.9 in the metabolic syndrome group with a mean of 17.53 which was significantly higher than the psoriasis without metabolic group with a mean of 10.71 and a range of 4.0 to 28.2 (Table 3).

There was a significant difference between the groups respecting clinical and laboratory data, metabolic syndrome severity score (MSSS), adiponectin, and myonectin (p<0.05). Adiponectin and myonectin were significantly lower in psoriasis with the metabolic group in comparison to psoriasis without the metabolic group. Both groups had significantly lower diponectin and amyonectin levels than the control group (Table 4).

As regards PASI score, with a mean of 14.12±8.58, and adiponectin levels, with a mean of 7.37±0.85 (p=0.08) and myonectin levels, with a mean of 1.99±0.86 (p=0.407), we weren't able to find a statistically significant relationship between PASI and adiponectin or myonectin. Metabolic syndrome severity score, with a mean of 0.51±0.80, was found to be inversely related to adiponectin levels, with a mean of 7.37±0.85 (p=0.04). Metabolic syndrome severity score, with a mean of 0.51±0.80, was found to be inversely related to myonectin levels, with a mean of 1.99±0.86. There was a statistically significant relationship between adiponectin, with a mean of 7.37±0.85, and myonectin, with a mean of 1.99±0.86. There was not a highly statistically significant positive association between PASI score and MetS parameters studied in both psoriasis groups (Table 5).

Table 1: Demographic and anthropometric data of the studied groups

Variables	Psoriasis with metabolic (n=15)		Psoriasis without metabolic (n=15)		Control group (n=15)		F	P value
Gender	N	%	N	%	N	%	Chi-Square 0.180	0.914 NS
Male	8	53.3	9	60	8	53.3		
Female	7	46.7	6	40	7	46.7		
	Mean ± SD						F	P value
Age	47.73±16.34		47.33±15.26		40.00±7.62		1.529	0.229 NS
Range	20 – 71		20 – 68		28 – 54			
Weight	91.40±11.39		76.87±13.80		75.60±4.64		10.152	<0.001
Height	1.64±0.05		1.63±0.05		1.66±0.05		0.822	0.446
BMI	34.11±4.93		28.74±4.80		27.53±1.74		10.947	<0.001
p>0.05: Non significant and P<0.05: Significant								

Table 2: Severity of psoriasis according to PASI score

Severity	No among the metabolic syndrome group	%	No among non-metabolic group	%
Mild < 10	3	10%	7	23%
Moderate 10-20	9	30%	6	20%
Severe > 20	3	10%	2	7%

Table 3: Severity of psoriasis among studied cases

PASI score	PASI score Mean ± SD	T test	P value
Psoriasis with metabolic (n=15)	17.53±9.14 7.6 – 42.9	2.342	0.027 Significant
Psoriasis without metabolic (n=15)	**10.71±6.62** **4.0 – 28.2**		
Both groups (n=30)	**14.12±8.58** **4.0 – 42.9**		
p>0.05: Non significant and P<0.05: Significant			

Table 4: Clinical and laboratory data among the studied groups

Variables	Psoriasis with metabolic (n=15)	Psoriasis without metabolic (n=15)	Control group (n=15)	F	P value
	Mean ± SD				
WC	111.60±13.37 94 – 135	93.87±13.56 73 – 133	91.13±4.93 83 – 100	14.365	<0.001 HS
SBP	143.00±9.41 120 – 160	125.33±5.50 110 – 130	124.00±6.33 110 – 160	31.873	<0.001 HS
DBP	96.33±11.57 80 – 120	83.33±3.62 80 – 90	81.67±5.56 70 – 90	16.315	<0.001 HS
HDL	41.73±7.37 28 – 52	46.28±10.39 29 – 70	49.67±6.35 38 – 60	3.523	0.039 Significant
LDL	143.28±32.44 84 – 209	132.82±53.29 27 – 210	66.35±24.44 35 – 114	17.457	<0.001 HS
TC	218.27±34.93 167 – 276	198.61±62.06 98 – 290	139.46±24.92 99 – 180	13.297	<0.001 HS
TRG	188.37±81.65 111 – 424	130.86±68.13 73 – 351	117.26±25.06 67 – 150	5.371	0.008 Significant
FBG	122.91±46.63 75 – 248	109.49±39.10 79 – 244	92.53±11.77 68 – 123	14.365	<0.001 HS
MSSS	1.31±0.60 0.70 – 2.58	0.32±0.63 -0.72 – 1.70	0.08±0.39 -0.89 – 0.62	25.668	<0.001 HS
Adiponectin	6.83±0.45 6.08 – 7.89	7.32±0.62 6.42 – 8.47	7.94±1.01 6.42 – 9.94	8.745	<0.001 HS
Myonectin	1.50±0.42 1.08 – 2.81	1.76±0.24 1.44 – 2.25	2.73±1.09 1.63 – 6.40	13.189	<0.001 HS

WC: Waist circumference, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HDL: High density lipoproteins, LDL: Low density lipoproteins, TC: Total cholesterol, TRG: Triglycerides and FBG: Fasting blood glucose
p>0.05: Non significant and P<0.05: Significant

Table 5: The relations between adiptonectin, myonectin, PASI, and MSSS

Variables	N = 30	R	P value
	Mean ± SD		
Adiponectin	7.37±0.85 6.08 – 9.94	-0.318	0.087
PASI	14.12±8.58 4.0 – 42.9		
Myonectin	1.99±0.86 1.08 – 6.40	0.159	0.407
PASI	14.12±8.58 4.0 – 42.9		
Adiponectin	7.37±0.85 6.08 – 9.94	-0.271	0.042
MSSS	0.51±0.80 -0.89 – 2.85		
Myonectin	1.99±0.86 1.08 – 6.40	-0.298	0.047
MSSS	0.51±0.80 -0.89 – 2.85		
Adiponectin	7.37±0.85 6.08 – 9.94	0.656	< 0.001
Myonectin	1.99±0.86 1.08 – 6.40		
PASI	14.12±8.58 4.0 – 42.9	0.192	0.310
MSSS	0.51±0.80 -0.72 – 2.85		

p>0.05: Non significant and P<0.05: Significant

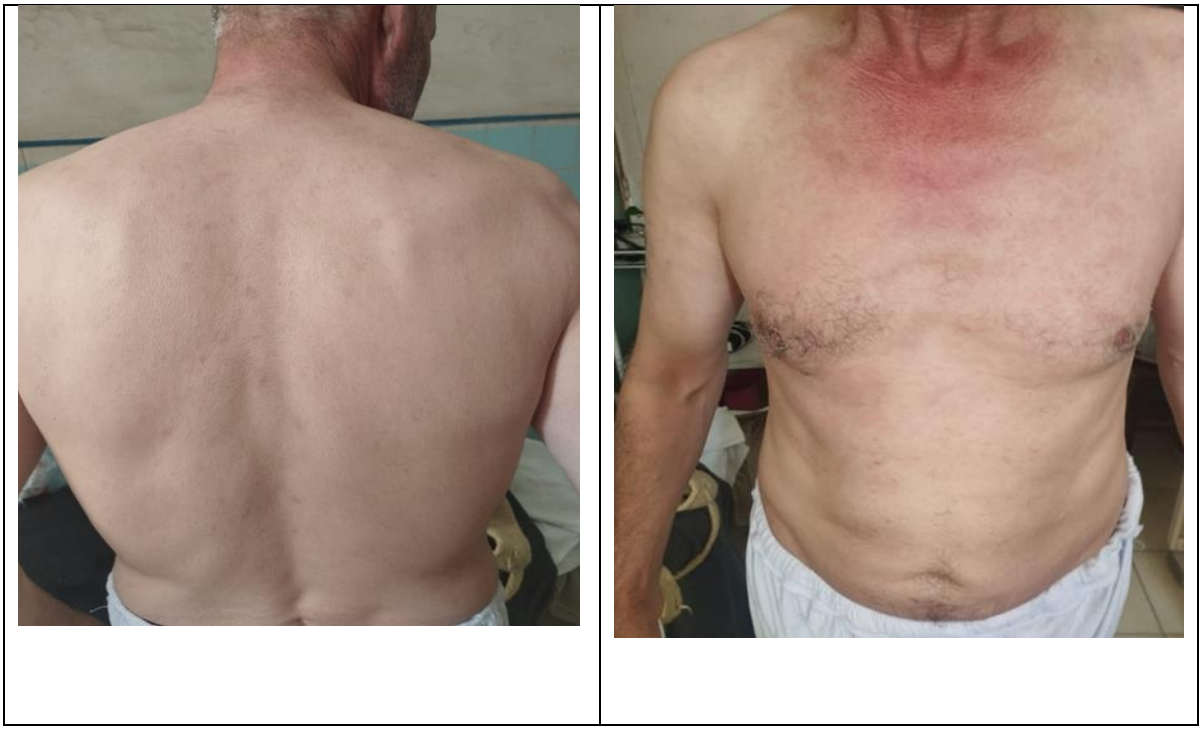

Figure 1: 61-year-old psoriasis male patient who participated in our study. He has mild psoriasis with PASI score = 5.6.

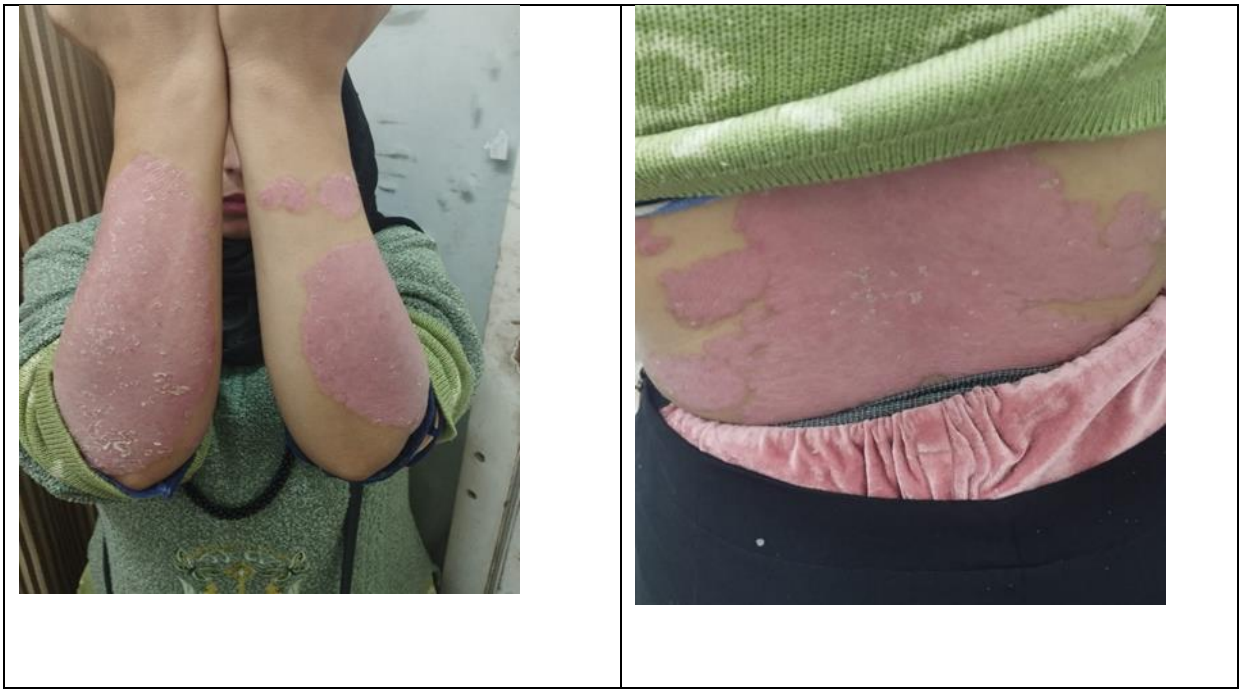

Figure 2: 38-year-old psoriasis female patient who participated in our study. She has severe psoriasis with PASI score = 47.2.

DISCUSSION

Psoriasis is an inflammatory skin condition that is primarily caused by aging and hereditary predisposition. However, various environmental risk factors, including injury, infection, and medications, have been shown to affect the onset of this inflammatory skin condition. Around 2% of people globally are affected by this disease, but it varies a little depending on the type of skin [12].

Increased waist circumference (WC) is a MetS diagnostic characteristic. This study revealed that waist circumference was statistically higher in psoriatic patients who have metabolic syndrome ($P < 0.001$) in comparison with both psoriatic patients who don't have metabolic syndrome and the control group which was slightly lower than psoriasis without metabolic syndrome group. This is supported by two recent reports done by Ramírez-Terán et al., and Choudhary et al. [13,14].

As regards blood pressure, our study revealed that SBP and DBP were significantly elevated in psoriatic cases with MetS ($P < 0.001$) in comparison to both psoriasis patients who don't have metabolic syndrome and the control group which was slightly lower than psoriasis without metabolic syndrome group. This agreed with the studies by Rathod et al., and Duan et al. [15,16].

Our study showed that total cholesterol was significantly higher in psoriasis with the metabolic group than in psoriasis without the MetS group. Both were significantly higher than the control. This is supported by previous studies [17–19].

We noticed that triglyceride level was remarkably elevated in psoriasis with the MetS group compared with psoriasis without the MetS group. Both were significantly elevated than control. This follows the studies by Ramezani et al., [17] and Fernández-Armenteros et al., [20]. But Ma et al., reported no significant variation in TG levels between psoriasis and control groups [21].

The present study found a lower HDL level in psoriatic patients with MetS in comparison to psoriatic cases without MetS. Both were significantly lower than control ($P = 0.039$). This is supported by the studies by Ma et al., [22] and Sirin et al. [23].

We noticed that low-density lipoproteins (LDL) level was significantly higher in psoriasis with the MetS group than in psoriasis without the MetS group. Both were significantly higher than the control. This was agreed with the studies by Shih et al., [24] and Kaur et al., [25].

As regards fasting blood glucose, it was significantly higher in psoriasis with the MetS group than in psoriasis without the MetS group. Both were remarkably higher than control ($P < 0.001$). This is supported by Brazzelli et al., [26]. In contrast, Wen et al. reported no significant variance in fasting blood glucose levels between psoriasis patients and control groups [27].

The PASI score which we used to measure psoriasis severity was found to be higher in psoriasis patients with metabolic syndrome than in psoriasis cases without metabolic syndrome ($P = 0.027$). Among the subjects more mild psoriasis cases which we defined as PASI less than 10 were free of metabolic syndrome while more moderate and severe cases were diagnosed with metabolic syndrome. This resembles the findings by Malkic Salihbegovic et al. [28].

Metabolic syndrome expressed as metabolic syndrome severity score "MSSS" was higher in psoriasis with MetS group than psoriasis without MetS group. Both were notably higher than control. This is supported by several studies which illustrated the relationship between psoriasis and metabolic syndrome [29,30]. No statistically significant relationship was found between psoriasis severity assessed by PASI score and metabolic syndrome severity score assessed by MSSS and Z-score.

Adiponectin was significantly lower in psoriasis with MetS group than in psoriatic patients without MetS, both groups had a significantly lower adiponectin level than control. These results are supported by the studies of Ruiyang et al. [31] and Słuczanowska-Głabowska et al. [32].

There was no statistically marked association between serum adiponectin levels and PASI score ($P = 0.087$). This was agreed with the results of Kaur et al. [33].

Myonectin was significantly lower in psoriasis with the metabolic group in comparison to psoriasis without the metabolic group. Both groups had significantly lower myonectin levels than the control. There was no statistically significant relation between serum myonectin levels and PASI score ($P = 0.407$). Interestingly, this study is a pioneer in showing the correlation between psoriasis and myonectin.

We found adiponectin to be inversely related to metabolic syndrome parameters in a statistically significant manner ($P = 0.042$). This is supported by Nesic et al. [34].

Regarding myonectin, we found it to be inversely related to metabolic syndrome parameters in a statistically significant manner (P = 0.042). This is supported by Petro et al. [35].

We found a statistically significant direct relationship between adiponectin and myonectin. To our knowledge, this study was the first to study the correlation between adiponectin and myonectin.

Adiponectin (ADPN) is an anti-inflammatory, antidiabetic, and antioxidant agent which is potent against chronic diseases. Exogenous recombinant ADPN was found to be useful in stroke treatment in animal studies. Exogenous ADPN injected before middle cerebral artery occlusion had a protective effect on infarct size and neurological deficit scores [36].

In diabetic mice, ADPN treatment reverses insulin resistance by elevating oxidation of fatty acid in skeletal muscle, which in turn lowers TAG and FFA levels in serum and tissues. Insulin resistance in diabetic mice is reversed by ADPN injection, which elevates fatty acid oxidation in skeletal muscle and consequently lowers serum and tissue levels of FFA and TAG [37].

Hesperidin can dramatically lessen psoriasis-like skin damage in rats and stop the growth of immortalized keratinocytes in humans. Adiponectin levels in mice were markedly increased after hesperidin treatment, and PASI scores were noticeably decreased. Pro-inflammatory factor secretion in skin lesions, epidermal differentiation, thickness, and hyperproliferation were all decreased [38].

Recombinant myonectin administration to mice lowers levels of circulating free fatty acids by encouraging free fatty acid absorption [39].

Following an oral lipid challenge, blood TG and NEFA levels considerably increased in myonectin-KO male mice, who had the myonectin-producing genes removed [40].

Psoriasis is a chronic multifactorial inflammatory disease. So knowledge of association between it and metabolic syndrome and adipokines such as adiponectin and myokines such as myonectin can be important in achieving a better understanding of the disease pathogenesis.

CONCLUSION

Patients with psoriasis are more likely to have dyslipidemia and the basic elements of the metabolic syndrome. This emphasizes the importance of screening all psoriasis cases for related MetS to detect it early and treat it to lower morbidity and mortality. Adiponectin and myonectin levels were much elevated in the control group than in psoriasis patients. Regarding psoriasis patients, both were lower in metabolic syndrome patients than those who are free of it. Measuring their levels can serve as a measurement for the progression of both psoriasis and metabolic syndrome

CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

References

1. Gudjonsson JE, Elder JT. Chapter 18. Psoriasis. In: Goldsmith LA, Katz SI, Gilchrest BA, Paller AS, Leffell DJ, Wolff K, eds. Fitzpatrick's Dermatology in General Medicine, 8e. New York, NY: The McGraw-Hill Companies; 2012. accessmedicine.mhmedical.com/content.aspx?aid=56025003. Accessed July 20, 2023.
2. Nabieva K, Vender R. Quality of Life and Body Region Affected by Psoriasis: A Systematic Review. Actas Dermosifiliogr. 2023;114(1):33-8.
3. Gisondi P, Fostini AC, Fossà I, Girolomoni G, Targher G. Psoriasis and the metabolic syndrome. Clin Dermatol. 2018;36(1):21-8.
4. Ghadge AA, Khaire AA, Kuvalekar AA. Adiponectin: A potential therapeutic target for metabolic syndrome. Cytokine Growth Factor Rev. 2018;39:151-8.
5. Otaka N, Shibata R, Ohashi K, et al. Myonectin Is an Exercise-Induced Myokine That Protects the Heart From Ischemia-Reperfusion Injury. Circ Res. 2018;123(12):1326-38.
6. Pourranjbar M, Arabnejad N, Naderipour K, Rafie F. Effects of Aerobic Exercises on Serum Levels of Myonectin and Insulin Resistance in Obese and Overweight Women. J Med Life. 2018;11(4):381-6.
7. Hubbs L, Tuleya S. Psoriasis update. SKIN AND AGING. 2007;15(1):56.
8. Artiss JD, Zak B. Measurement of cholesterol concentration. Handbook of lipoprotein testing. 1997;2:189-205.
9. Rifai N, Warnick GR, Dominiczak MH. Handbook of Lipoprotein Testing. Amer. Assoc. for Clinical Chemistry; 2000.
10. Trinder P. Determination of Glucose in Blood Using Glucose Oxidase with an Alternative Oxygen Acceptor. Ann Clin Biochem. 1969;6(1):24-7.
11. Soldatovic I, Vukovic R, Culafic D, Gajic M, Dimitrijevic-Sreckovic V. siMS Score: Simple

Method for Quantifying Metabolic Syndrome. PLoS One. 2016;11(1):e0146143.
12. Samotij D, Nedoszytko B, Bartosińska J, et al. Pathogenesis of psoriasis in the "omic" era. Part I. Epidemiology, clinical manifestation, immunological and neuroendocrine disturbances. Postepy Dermatol Alergol. 2020;37(2):135-53.
13. Ramírez-Terán AL, Vega-Memije ME, Torres-Tamayo M, Martínez-Alvarado MR. Carotid intima-media thickness in patients with psoriasis with and without metabolic syndrome. Arch Cardiol Mex. 2022;92(3):305-11.
14. Choudhary S, Patel R, Pradhan D, et al. Psoriasis and cardiovascular disorders: association or epiphenomenon? Meta-analysis of observational studies. 3 Biotech. 2020;10(3):104.
15. Rathod A, Neema S, Radhakrishnan S, Vendhan S, Tripathy DM, Vasudevan B. Palmoplantar Plaque Psoriasis is Associated with Diabetes, Hypertension, Obesity, and Metabolic Syndrome-A Case-Control Study. Indian Dermatol Online J. 2022;13(5):606-10.
16. Duan X, Liu J, Mu Y, et al. A systematic review and meta-analysis of the association between psoriasis and hypertension with adjustment for covariates. Medicine (Baltimore). 2020;99(9):e19303.
17. Ramezani M, Zavattaro E, Sadeghi M. Evaluation of serum lipid, lipoprotein, and apolipoprotein levels in psoriatic patients: a systematic review and meta-analysis of case-control studies. Postepy Dermatol Alergol. 2019;36(6):692-702.
18. Dowlatshahi EA, van der Voort E a. M, Arends LR, Nijsten T. Markers of systemic inflammation in psoriasis: a systematic review and meta-analysis. Br J Dermatol. 2013;169(2):266-82.
19. Varshney P, Narasimhan A, Mittal S, Malik G, Sardana K, Saini N. Transcriptome profiling unveils the role of cholesterol in IL-17A signaling in psoriasis. Sci Rep. 2016;6:19295.
20. Fernández-Armenteros JM, Gómez-Arbonés X, Buti-Soler M, et al. Psoriasis, metabolic syndrome and cardiovascular risk factors. A population-based study. J Eur Acad Dermatol Venereol. 2019;33(1):128-35.
21. Ma C, Schupp CW, Armstrong EJ, Armstrong AW. Psoriasis and dyslipidemia: a population-based study analyzing the National Health and Nutrition Examination Survey (NHANES). J Eur Acad Dermatol Venereol. 2014;28(8):1109-12.
22. Ma C, Harskamp CT, Armstrong EJ, Armstrong AW. The association between psoriasis and dyslipidaemia: a systematic review. Br J Dermatol. 2013;168(3):486-95.
23. Sirin MC, Korkmaz S, Erturan I, et al. Evaluation of monocyte to HDL cholesterol ratio and other inflammatory markers in patients with psoriasis. An Bras Dermatol. 2020;95(5):575-82.
24. Shih CM, Chen CC, Chu CK, Wang KH, Huang CY, Lee AW. The Roles of Lipoprotein in Psoriasis. Int J Mol Sci. 2020;21(3):859.
25. Kaur S, Kingo K, Zilmer M. Psoriasis and Cardiovascular Risk-Do Promising New Biomarkers Have Clinical Impact? Mediators Inflamm. 2017;2017:7279818.
26. Brazzelli V, Maffioli P, Bolcato V, et al. Psoriasis and Diabetes, a Dangerous Association: Evaluation of Insulin Resistance, Lipid Abnormalities, and Cardiovascular Risk Biomarkers. Front Med (Lausanne). 2021;8:605691.
27. Wen S, Liu C, Li Y, Pan J, Nguyen T, Zhou L. Psoriasis Exacerbates the State of Insulin Resistance in Patients with Type 2 Diabetes. Diabetes Metab Syndr Obes. 2021;14:2389-97.
28. Malkic Salihbegovic E, Hadzigrahic N, Cickusic AJ. Psoriasis and metabolic syndrome. Med Arch. 2015;69(2):85-7.
29. Choudhary S, Pradhan D, Pandey A, et al. The Association of Metabolic Syndrome and Psoriasis: A Systematic Review and Meta-Analysis of Observational Study. Endocr Metab Immune Disord Drug Targets. 2020;20(5):703-17.
30. Caroppo F, Galderisi A, Moretti C, Ventura L, Belloni Fortina A. Prevalence of psoriasis in a cohort of children and adolescents with type 1 diabetes. J Eur Acad Dermatol Venereol. 2021;35(9):e589-e91.
31. Ruiyang B, Panayi A, Ruifang W, Peng Z, Siqi F. Adiponectin in psoriasis and its comorbidities: a review. Lipids Health Dis. 2021;20(1):87.
32. Słuczanowska-Głabowska S, Staniszewska M, Marchlewicz M, et al. Adiponectin, Leptin and Resistin in Patients with Psoriasis. J Clin Med. 2023;12(2):663.
33. Kaur S, Zilmer K, Leping V, Zilmer M. The levels of adiponectin and leptin and their relation to other markers of cardiovascular risk in patients with psoriasis. J Eur Acad Dermatol Venereol. 2011;25(11):1328-33.
34. Nesic J, Ljujic B, Rosic V, et al. Adiponectin and Interleukin-33: Possible Early

Markers of Metabolic Syndrome. J Clin Med. 2022;12(1):132.
35. Petro JL, Fragozo-Ramos MC, Milán AF, Aristizabal JC, Gallo-Villegas JA, Calderón JC. Serum Levels of Myonectin Are Lower in Adults with Metabolic Syndrome and Are Negatively Correlated with Android Fat Mass. Int J Mol Sci. 2023;24(8):6874.
36. Song W, Huo T, Guo F, et al. Globular adiponectin elicits neuroprotection by inhibiting NADPH oxidase-mediated oxidative damage in ischemic stroke. Neuroscience. 2013;248:136-144. doi:10.1016/j.neuroscience.2013.05.063
37. Kim YM, Park JS, Choi HJ, et al. Efficient production of recombinant human adiponectin in egg white using genome edited chickens. Front Nutr. 2022;9:1068558.
38. Li X, Xie X, Zhang L, et al. Hesperidin inhibits keratinocyte proliferation and imiquimod-induced psoriasis-like dermatitis via the IRS-1/ERK1/2 pathway. Life Sci. 2019;219:311-21.
39. Seldin MM, Peterson JM, Byerly MS, Wei Z, Wong GW. Myonectin (CTRP15), a novel myokine that links skeletal muscle to systemic lipid homeostasis. J Biol Chem. 2012;287(15):11968-80.
40. Little HC, Rodriguez S, Lei X, et al. Myonectin deletion promotes adipose fat storage and reduces liver steatosis. FASEB J. 2019;33(7):8666-87.

Citation

Edrees, A., Kandil, A., Khater, E., Baraka, A. Evaluation of Serum Levels of Adiponectin and Myonectin in Psoriasis Vulgaris Patients with and Without Metabolic Syndrome. Zagazig University Medical Journal, 2024; (4034-4043): -. doi: 10.21608/zumj.2023.226919.2838