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# Prevalence of metabolic syndrome in Montenegrin patients with psoriasis

## Prevalencija metaboličkog sindroma kod bolesnika sa psorijazom u Crnoj Gori

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**Abstract**

**Background/Aim.** Increasing epidemiological studies suggest the association between psoriasis and metabolic syndrome. The aim of this study was to assess the association of metabolic syndrome and its components with psoriasis in a sample of patients from Montenegro, and to predict the factors that determine the metabolic syndrome. **Methods.** A case-control study was conducted at the Clinic of Dermatology and Venereology, Clinical Center of Montenegro, Podgorica, Montenegro, between January and December 2012. The study group included 101 patients with psoriasis (cases) and 126 patients with the diagnosis of dermatological disease other than psoriasis (controls) consecutively admitted to the same clinic. **Results.** Metabolic syndrome was more prevalent in the psoriasis patients than in the controls (48.5% *vs* 20.6%; OR = 2.99). In addition, the psoriasis patients were significantly more likely to be smokers (OR = 2.16) and were less physically active (OR = 0.58). **Conclusion.** The results of this study demonstrate a strong association between psoriasis and metabolic syndrome independent of psoriasis severity. Patients with psoriasis should be routinely screened for metabolic syndrome and its components.

**Key words:**
**metabolic syndrome x; psoriasis; comorbidity; prevalence; risk factors; montenegro.**

**Apstrakt**

**Uvod/Cilj.** Sve veći broj epidemioloških studija ukazuje na povezanost psorijaze sa metaboličkim sindromom. Cilj ove studije bio je da se proceni veza između metaboličkog sindroma i njegovih komponenti i psorijaze u uzorku bolesnika sa ovom bolešću iz Crne Gore, kao i da se predvide faktori koji determinišu metabolički sindrom. **Metode.** Studija slučajeva i kontrola sprovedena je na Klinici za dermatologiju i venerologiju Kliničkog centra Crne Gore, Podgorica, Crna Gora, u periodu januar–decembar, 2012. godine. U grupi obolelih bio je 101 bolesnik sa dijagnozom psorijaze, dok su kontrolnu grupu činili konsekutivni pacijenti iste klinike koji nisu imali psorijazu (126), već neku drugu kožnu bolest. **Rezultati.** Prevalencija metaboličkog sindroma bila je veća kod bolesnika sa psorijazom u poređenju sa bolesnicima iz kontrolne grupe [48,5% naspram 20,6%; unakrsni odnos (UO) = 2,99]. Bolesnici sa psorijazom bili su statistički značajno češće pušači (UO = 2,16) i manje fizički aktivni (UO = 0,58). **Zaključak.** Rezultati ove studije pokazuju jaku povezanost između psorijaze i metaboličkog sindroma, nezavisno od težine kliničke slike. Bolesnike sa psorijazom treba podvrgnuti redovnom pregledu na prisustvo metaboličkog sindroma i njegovih komponenti.

**Ključne reči:**
**metabolički sindrom x; psorijaza; komorbiditet; prevalenca; faktori rizika; crna gora.**

### Introduction

Psoriasis is one of the most common chronic inflammatory skin diseases associated with a significant morbidity and substantial economic costs to health care systems and patients worldwide [1]. It has a significant impact on patients's quality of life [2–5]. This may lead to unhealthy lifestyle choices, which in turn, increases the risk of several diseases including the metabolic syndrome.

Metabolic syndrome is a clustering of risk factors which include central obesity, hypertension, dyslipidemia [raised triglycerides and lowered high-density lipoprotein (HDL) cholesterol], and raised fasting glucose. This syndrome is a strong predictor of cardiovascular diseases and type 2 diabetes mellitus [6–9].

Increasing epidemiological evidence suggests the association between psoriasis and metabolic syndrome [10–16].

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The aim of this study was to investigate the association of metabolic syndrome and its components with psoriasis, and to predict the factors that determine metabolic syndrome in psoriatic patients from Montenegro.

## Methods

### *Study design and participants*

A case-control study was conducted at the Clinic of Dermatology and Venereology, Clinical Center of Montenegro (CCM), Podgorica, Montenegro, between January and December 2012. The study group included 101 patients with psoriasis (cases) and 126 patients without psoriasis (controls) consecutively admitted to the same clinic.

The inclusion criteria for the cases were age 18 years or older, clinical diagnosis of chronic plaque psoriasis, disease duration of at least six months and not receiving any systemic treatment for psoriasis for at least one month before enrolment.

The control group consisted of patients aged 18 years and more with the diagnosis of dermatological disease other than psoriasis and any autoimmune or chronic inflammatory disease (such as basal cell carcinoma, eczema, vitiligo and infective skin diseases).

The study was approved by the Ethics committee of the CCM. Written informed consent was obtained from all the patients.

### *Study variables*

A standardized questionnaire was used to collect the main characteristics of the patients (age, sex, education, smoking habits, physical activity and family history of psoriasis), and clinical characteristics of psoriasis such as disease onset and duration of the disease.

Education levels were categorized as low (no schooling, incomplete primary school and primary school), middle (three or four years of secondary school), and high (college and university education). Smoking status was categorized as never, former and current. Physical activity in this study was measured with a question: "In your leisure time, how often do you do physical exercise for at least 30 minutes which makes you at least mildly short of breath or perspire?" Those who participated in physical activity four times or more a week were categorized as active, those who exercised less than four times a week but at least 2–3 times a months were categorized as moderately (in)active and those who exercised several times a year or did not exercise at all were categorized as inactive.

The Psoriasis Area and Severity Index (PASI) was used in evaluating the disease severity by physicians. The PASI is a composite index providing an area-weighted assessment of the severity of psoriasis. It can vary from 0 (the lowest score) to 72 (the highest score), with higher scores indicating greater severity [17]. Usually, a PASI score of 10 is used as a cut-off point for mild and moderate/severe psoriasis in daily clinical practice. However, most severe forms of psoriasis are treated at the CCM as a tertiary care hospital and center of excellence for dermatology; therefore, we set a higher criterion of clinical severity and defined psoriasis as mild (PASI $\leq 20$), moderate (PASI 21–29), or severe (PASI $\geq 30$).

Anthropometric measures recorded were weight, height and waist circumference. Measures of weight (kilograms) and height (meters) were assessed using a standard physician's scale and a stadiometer, respectively. Waist circumference (centimetres) was measured at the minimum circumference between the iliac crest and the rib cage. Body mass index (BMI) was calculated as weight in kilograms divided by squared height in meters ($kg/m^2$). According to World Health Organization [18] overweight was defined as BMI $\geq 25$ $kg/m^2$ and $< 30$ $kg/m^2$, and obese as BMI $\geq 30$ $kg/m^2$.

Sitting blood pressure (BP) was measured three times after a 5 min rest. The average of the last two measurements was used for analysis.

Blood was collected following 8 or more hours of fasting for measurement of plasma lipids (triglycerides, total cholesterol and low HDL cholesterol) and glucose.

### *Assessment of metabolic syndrome*

Metabolic syndrome was diagnosed according to the American Heart Association/National Heart, Lung and Blood Institute [modified Adult Treatment Panel III (ATPIII)] criteria [19]. At least 3 of the following conditions had to be present: abdominal obesity presented as large waist circumference (men: $\geq 102$ cm; women: $\geq 88$ cm), elevated triglyceride level ($\geq 1.7$ mmol/L), low HDL cholesterol levels (men: $< 1.0$ mmol/L; women: $< 1.3$ mmol/L), hypertension ($\geq 130/85$ mm Hg or treated hypertension) or elevated fasting glucose level ($\geq 5.6$ mmol/L or treated diabetes).

### *Statistical analysis*

Continuous variables were described by the means and SD, while categorical ones with frequencies and percentages.

The comparison of the groups with/without psoriasis and with/without metabolic syndrome was performed by bivariate analysis, taking $\chi^2$ test and Student's *t*-test where appropriate. Multivariate logistic regression analysis was performed to examine the relationship between psoriasis and potential risk factors. The dependent variable was belonging to cases (psoriatic patients)/controls (non-psoriatic patients).

All statistical analyses were performed using SPSS version 20.0 software (SPSS Inc., Chicago, IL, USA). Statistical significance was set at 2-sided $p < 0.05$.

## Results

The study included 101 patients with the diagnosis of psoriasis (cases) and 126 patients with diagnosis of skin disease other than psoriasis (controls). Table 1 shows the description of the study population. The psoriatic patients were older, and compared with the controls reported more frequently cigarette smoking, physical inactivity and family history of psoriasis. They also had higher means of BMI, blood pressure, and glucose and lower mean of HDL-cholesterol.

Comparing the presence of metabolic syndrome and all its components in the cases and controls (Table 2), we observed that metabolic syndrome, low HDL-cholesterol, elevated blood pressure, high glucose level, and BMI > 25 kg/m$^2$ were more prevalent in the psoriatic patients.

The comparison of the subjects with psoriasis alone with those with psoriasis and metabolic syndrome is shown in Table 3. The psoriatic patients with metabolic syndrome were older, had longer disease duration and a higher BMI. No relationship was observed regarding gender, the prevalence of smoking, disease onset or psoriasis severity (Table 3).

The results of multivariate logistic regression showed that psoriasis patients compared to controls were older, more frequently were smokers and more frequently had metabolic syndrome, while less frequently were physically active (Table 4).

**Table 1**

**Characteristics of the study patients according to the presence of psoriasis**

| Parameters | Psoriasis (n = 101) | No psoriasis (n = 126) | *p* |
|---|---|---|---|
| Age (years), mean ± SD | 50.00 ± 14.39 | 43.70 ± 14.62 | 0.001* |
| Sex, n (%) | | | |
| male | 51 (50.5) | 49 (38.9) | |
| female | 50 (49.5) | 77 (61.1) | 0.080† |
| Education, n (%) | | | |
| low | 8 (7.9) | 15 (11.9) | |
| middle | 57 (56.4) | 59 (46.8) | |
| high | 36 (35.7) | 52 (41.3) | 0.416† |
| Cigarette smoking, n (%) | | | |
| never smoker | 47 (46.5) | 70 (55.6) | |
| former smoker | 12 (11.9) | 25 (19.8) | |
| current smoker | 42 (41.6) | 31 (24.6) | 0.017† |
| Physical activity, n (%) | | | |
| inactive | 64 (63.4) | 50 (39.7) | |
| intermediate active | 32 (31.7) | 52 (41.3) | |
| active | 5 (5.0) | 24 (19.0) | 0.000† |
| Family history of psoriasis, n (%) | 36 (35.6) | 2 (1.6) | 0.000† |
| Body mass index (kg/m$^2$), mean ± SD | 26.81 ± 3.17 | 25.45 ± 5.12 | 0.020* |
| Waist circumference (cm), mean ± SD | 88.98 ± 13.01 | 85.63 ± 13.70 | 0.062* |
| Systolic blood pressure (mmHg), mean ± SD | 146.19 ± 18.88 | 119.02 ± 11.01 | 0.000* |
| Diastolic blood pressure (mmHg), mean ± SD | 93.56 ± 9.96 | 75.29 ± 8.40 | 0.000* |
| Triglycerides (mmol/L ), mean ± SD | 1.31 ± 0.54 | 1.49 ± 1.04 | 0.116* |
| HDL-cholesterol (mmol/L), mean ± SD | 1.03 ± 0.41 | 1.34 ± 0.44 | 0.000* |
| Glucose (mmol/L), mean ± SD | 5.40 ± 1.20 | 4.79 ± 0.83 | 0.000* |

**SD – standard deviation; HDL – high-density lipoprotein; **t*-test; †$\chi^2$ test.**

**Table 2**

**Prevalence of metabolic syndrome and its components in the study patients according to the presence of psoriasis**

| Parameters | Psoriasis (n = 101) | No psoriasis (n = 126) | *p* |
|---|---|---|---|
| Waist circumference ≥ 102 cm (men) and ≥ 88 cm (women), n (%) | 34 (33.7) | 33 (26.2) | 0.220* |
| Body mass index ≥ 25 kg/m$^2$ (overweight + obesity), n (%) | 75 (74.3) | 57 (45.3) | 0.000* |
| Triglycerides ≥ 1.7 mmol/L, n (%) | 20 (19.8) | 31 (24.6) | 0.389* |
| HDL-cholesterol < 1.0 mmol/L (men) and < 1.3 mmol/L (women), n (%) | 74 (73.3) | 49 (38.9) | 0.000* |
| Blood pressure (systolic ≥ 130 mmHg or diastolic ≥ 85 mmHg), n (%) | 82 (81.2) | 33 (26.2) | 0.000* |
| Diabetes mellitus type 2 or glucose ≥ 5.6 mmol/L, n (%) | 44 (43.6) | 17 (13.5) | 0.000* |
| Metabolic syndrome, n (%) | 49 (48.5) | 26 (20.6) | 0.000* |
| Components of metabolic syndrome, mean ± SD | 2.15 ± 0.96 | 1.29 ± 1.30 | 0.000† |

**SD – standard deviation; HDL – high-density lipoprotein; *χ2 test; †*t*-test.**

**Table 3**

**Characteristics of the psoriatic patients according to the presence of metabolic syndrome (MetS)**

| Parameters | Psoriatic patients with MetS (n = 49) | Psoriatic patients without MetS (n = 52) | *p* |
|---|---|---|---|
| Age (years), mean ± SD | 55.22 ± 11.83 | 46.13 ± 15.27 | 0.001* |
| Sex (males/females) n (%) | 24 (49.00)/25 (51.00) | 27 (51.90)/25 (48.10) | 0.767† |
| Age of onset (years), mean ± SD | 42.20 ± 9.36 | 38.06 ± 11.45 | 0.050* |
| Duration of psoriasis (years), mean ± SD | 12.88 ± 7.69 | 8.09 ± 8.05 | 0.003* |
| Smoking (current), n (%) | 20 (40.8) | 22 (42.9) | 0.767† |
| BMI, mean ± SD | 28.39 ± 2.60 | 25.33± 2.95 | 0.000* |
| PASI, mean ± SD | 28.31 ±9.47 | 27.59 ± 13.66 | 0.761* |
| PASI ≤ 20, n (%) | 10 (20.4) | 17 (32.7) | |
| PASI 21–29, n (%) | 17 (34.7) | 14 (26.9) | |
| PASI ≥ 30, n (%) | 22 (44.9) | 21 (40.4) | 0.360† |

**BMI – body mass index; PASI – psoriasis area and severity index; **t*-test; †$\chi^2$ test.**

**Table 4**

**Odds ratios for risk factors in the psoriatic patients *vs* the non-psoriatic patients – results of multivariate logistic regression analysis**

| Variable | Odds ratio | 95% Confidence intervals | *p* |
|---|---|---|---|
| Age | 1.03 | 1.01–1.06 | 0.005 |
| Sex | 0.64 | 0.35–1.19 | 0.161 |
| Smoking | 2.16 | 1.11–4.20 | 0.023 |
| Physical activity | 0.58 | 0.36–0.94 | 0.027 |
| Metabolic syndrome | 2.99 | 1.59–5.62 | 0.001 |

## Discussion

To our knowledge, this is the first study in Montenegro undertaken to assess the association between psoriasis and metabolic syndrome.

Our finding that the prevalence of metabolic syndrome was higher in psoriatic patients than in controls (OR = 2.99) is in agreement with a number of recently published studies [10, 11, 14, 20–24]. However, some studies found no statistical difference in metabolic syndrome between patients with psoriasis and controls [25–27]. It may be attributed to different criteria by which metabolic syndrome was assessed (WHO, NCEP – National Cholesterol Education Program, ATP III), and different population studied [23, 25].

Like in several previous studies [14, 21, 25, 26, 28] we found that metabolic syndrome in psoriatic patients was associated with older age. It was expected knowing that the individual components of metabolic syndrome are more common in the elderly. Older age of patients with metabolic syndrome directly correlates to disease duration: psoriatic patients with metabolic syndrome had a longer disease duration compared with psoriatic patients without this syndrome.

We did not find gender difference in the prevalence of metabolic syndrome in our study that is in accordance with several other studies [14, 26, 29]. However, some authors found that metabolic syndrome was significantly more common in female psoriatic patients [25, 27, 30]. Recently Danielsen et al. [24], in a large population based study, found the strongest association between metabolic syndrome and psoriasis in young women who had up to fourfold increased odds of metabolic syndrome. In contrast, according to Cohen et al. [28] the association between psoriasis and the metabolic syndrome was pronounced in men.

We found no difference in the severity of psoriasis between psoriatic patients with and without metabolic syndrome. No relationship was observed with either the PASI score or when the subjects were classified as having mild, moderate and severe psoriasis. Our finding is in agreement with several other studies [14, 25, 27, 30]. However, Langan et al. [10] demonstrated a strong association between psoriasis and metabolic syndrome, with increasing psoriasis severity being associated with increasing odds of metabolic syndrome. Kim et al. [26] also found that metabolic syndrome was associated with severe forms of psoriasis.

Our study shows that cigarette smoking is an independent risk factor for developing psoriasis (OR = 2.16). Smoking has been linked with psoriasis in numerous studies [31–33]. Patients with psoriasis are more likely to be current or former smokers [33]. According to Naldi et al. [34] the risk of psoriasis was higher in former smokers (OR = 1.9) and current smokers (OR = 1.7) than in never smokers.

Like in previous studies [35, 36] our psoriatic patients had positive family history of psoriasis more frequently than controls.

Concerning the individual components of the metabolic syndrome we found that they were more prevalent in the psoriatic patients compared to the controls, with the exception of hypertriglyceridemia.

Substantial evidence indicates an association between increased BMI and psoriasis suggesting that psoriasis patients are more frequently overweight or obese than the general population [37, 38]. In our study the psoriasis patients were more frequently overweight and obese (75%) compared with the controls (57%) that is in agreement with a number of case control studies [28, 34, 39]. We also found higher BMI in psoriatic patients with metabolic syndrome compared to those with psoriasis alone. This is logical given that BMI and abdominal (central) obesity strongly correlated. However, controversy still exists as to whether obesity causes or is a consequence of psoriasis [31, 40].

Like in several other studies [41–43] we observed that physical activity is negatively affected by psoriasis. Frankel et al. [44] found that vigorous physical activity was independently associated with a reduced risk of incident psoriasis in women. However, another study found no difference in mean physical activity between women with and without psoriasis [45].

Reduced physical activity contributes to increased adiposity, inflammation, oxidative stress, lipids and adhesion molecules, which are physiologically linked to psoriasis and its cardiometabolic co-morbidities [46].

Most of the studies performed showed that psoriasis is associated with atherogenic dyslipidemia [28, 37, 38]. Because psoriasis is associated with obesity and the excess adipose tissue might contribute to dyslipidemia, the exact relation of dyslipidemia in psoriasis is not clear [38]. According to Cohen et al. [28] it is possible that psoriasis is an inflammatory disease that is associated with atherosclerosis, similar to the association of atherosclerosis and some other diseases (e.g., lupus erythematosus and rheumatoid arthritis).

In the present study the psoriasis patients had more frequently low HDL cholesterol, compared to the controls without psoriasis, while we failed to find any statistically significant difference between the two groups in triglyceride levels.

The majority of studies have reported the prevalence of hypertension in psoriasis. Psoriasis patients showed several times higher prevalence of hypertension compared with other dermatological disease patients [21, 38]. A recent meta-analysis

concluded, that the OR for hypertension among patients with mild psoriasis was 1.30 [95% confidence interval (CI) 1.15–1.47] and 1.49 (95% CI 1.20–1.86) in patients with severe psoriasis compared with healthy controls [47].

A number of studies, including a large systematic review and meta-analysis, [6–9, 48] found the increased prevalence of diabetes mellitus type 2 in psoriatic patients, what is in accordance with our finding.

Some limitations within our study design should be considered. Firstly, the data are cross-sectional and do not allow us to determine which developed first, psoriasis or the metabolic syndrome. Secondly, factors which have not been evaluated in this study, including diet, alcohol, mental health or genetic predisposition, may be confounders or effect-modifiers in this relationship. Thirdly, the study was conducted in the tertiary care center and therefore the patients were biased toward having more severe psoriasis.

## Conclusion

This study confirms the association between psoriasis and metabolic syndrome. This finding supports regular screening for metabolic syndrome and its components among all psoriatic patients, regardless of age and disease severity, in order to reduce their risk of serious complications associated with metabolic syndrome. Moreover, the clinicians should be aware of the importance of recommending the patient lifestyle modifications.

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