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Sleep, eating and psychopathologies: Which one(s) may be associated with the development of metabolic syndrome in psoriasis patients through psoriasis quality of life?

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Abstract

Background: Psoriasis (PS) has many comorbidities including metabolic-syndrome (MetS) sleep and eating disorders and psychopathologies. *Objectives:* Investigating the relationship between the presence of MetS and sleep, eating and psychological pathologies in PS-patients through psoriasis quality of life (PSQoL). *Methods:* In this cross-sectional and descriptive correlation study**,** besides demographics, MetS-parameters and comorbidities, PS-severity, PS related quality of life (PSQoL), sleep-quality (SQ), depression, anxiety, body image-related QoL (BIQoL), perceived stress, flourishing, social appearance anxiety and eating attitudes of subjects were examined with related scales. Data analyzed using SPSS software, according to two PS groups with and without MetS. *Results:* Of 107 PS-patients, 68 were diagnosed with MetS. Mean-age and PS-duration were significantly higher in MetS (+) group. PS-severity was correlated with poor PSQoL, anxiety, depression, impairing flourishing, poor overall SQ and impairing in two sleep-subcomponents in MetS (+) group, whereas it was correlated with only poor PSQoL and poor overal SQ in MetS (-) group. Poor PSQoL was correlated with anxiety, depression, poor BIQoL, poor overal SQ and impairing in three sleep-subcomponents in MetS (+) group, whereas no correlation was found between these parameters and PSQoL in MetS(-) group. *Conclusions:* MetS is seen at high-rate in patients with long-term PS. PS-severity is especially correlated with anxiety, impaired-flourishing, and impaired-SQ in PS-patients with Mets (+). PSQoL appear to be correlated with depression, anxiety, distorted-BI and impaired SQ in these patients. It should be kept in mind that neuropsychological factors may facilitate the development of dysmetabolic events in PS-patients, by impairing PSQoL.

Keywords: Psoriasis, metabolic syndrome, eating disorders, sleep quality, psychopathology

INTRODUCTION

Psoriasis (PS) and metabolic syndrome (MetS) are chronic multisystem disorders.[1] They are associated with certain comorbidities such as diabetes mellitus (DM), hypertension (HT), sleep disturbances (SDs), eating disorders (EDs), psychological conditions such as anxiety (ANX) and depression (DEP), and impaired quality of life (QoL). Although some shared inflammatory cytokines and pathways have been blamed for this relationship, they have not been understood exactly.[1-3] Both psoriasis and comorbidities such as obesity, HT, hyperlipidemia, cardiovascular diseases (CVDs) and even resultant MetS are inflammatory diseases and they have similar immunological mechanisms. Elevated C-reactive protein [CRP], interleukin (IL)-6, and TNF-α levels increase in these diseases. Weight-loss improves the severity of PS by regressing CRP and IL-6. Also, the levels of cytokines such as resistin (increases insulin resistance) and leptin

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originating from adipose tissue have been found high levels in PS. Especially leptin has been shown significantly higher in PS patients with MetS, regardless of the presence of MetS.[1,4] On the other hand, emotional disorders such as ANX, DEP, and EDs may be involved in the pathogenesis of both PS and MetS.[1,3,5] CRP, IL-6, and TNF-α have been reported as shared cytokins in the pathogenesis of both DEP and PS.[4] EDs have been suggested as a cause of the metabolic or psychological consequences in PS-patients.[1,5] Especially, binge-eating disorder (BED) and night-eating syndrome (NES) are suggested to be related with obesity, higher risk for DM, psychopathologies, and SDs.[6] Furthermore, chronic SDs are associated with impaired QoL that may be caused by physiological, psychological and also metabolic reasons. Although the exact prevalence of SDs in PS-patients has not been fully elucicated, many PS-patients experience poor-SQ.[7] On the other hand health related QoL is a multidimensional concept and is described as an individual's perceived physical and mental health over time.[8] Since PS is a visual skin disease it leads to impair in persons' QoL as causes physical and psychological burdens.[1,8] Recently poor QoL is suggested as a causative factor in the development of MetS. Although there are a few studies regarding this topic, growing evidence increasingly supports this relationship.[9] Present study aimed to determine the correlative association between the presence of MetS and possible risk factors including SDs, EDs and certain psychopathologies in PS-patients through PS-related QoL.

METHODS

The study was designed as a cross-sectional and descriptive correlation study. It was conducted in accordance with the "World Medical Association Declaration of Helsinki, ethical principles for medical researches involving human subjects, 2008". After a local ethics committee approval (number: 1268) and written informed consent were obtained, a total of 107 subjects of both sexes (50 F & 57 M) with chronic plaque-PS were enrolled in the study. None of them had psoriatic arthritis. Persons who were admitted to our dermatology clinics were included in the study until subject numbers reached a predetermined sample size, which was detected as 97 with a 95% of confidence and a 5% margin of error. In case of any failure of subjects to adapt to the study, approximately 10% more subjects were included. Clinically diagnosis of PS was made by two dermatologist experienced in PS, and the diagnosis was confirmed by histopathological examination. SQ was determined by a sleep questionnaire which was evaluated by a neurologist, whereas psychological conditions of subjects were determined by a clinical psychologist, using related questionnairies. Inclusion criteria were as follows: volunteering for the study, ≥18 years of age, not being pregnant, adequate mental capacity to answer the questions, having no other dermatological, neurological, and psychological disorders in the last three-months, and the absence of previous MetS-diagnosis. Exclusion criteria were under the age of 18, having immunodeficiency, paitents under systemic PS-therapy such as methotrexate, cyclosporine, retinoids and biological agents, and current immunosupressive and antipsychotic therapy in the last three-months. Demographics, PS-duration, and known coexisted chronic diseases (DM, HT, thyroid disease, etc.) were also questioned. PS-severity, overal SQ, PS-related Quality of Life (PSQoL), and psychological conditions of the subjects were determined with Psoriasis Area Severity Index (PASI)[10], Pittsburgh Sleep Quality Index (PSQI)[11], Psoriasis Quality of Life Index (PQoLI)[8], Beck Depression Inventory (BDI)[12], Beck Anxiety Inventory (BAI)[13], Perceived Stress Scale (PSS)[14], Body image Quality of Life Inventory (BIQoLI)[15], Flourishing Scale (FS)[16], Turkish Emotional Eating Scale (TEES)[17] and Social Appearance Anxiety Scale (SAAS).[18] MetS findings were examined according to the criteria of the National Cholesterol Education Program Adult Treatment Panel III(ATPIII).[19]

Outcome measures

Anthropometric measures: BMI (Body mass index) and WC (Waist circumferences) of subjects were recorded. Blood pressures (Systolic-SBP and diastolic-DBP) were measured following the JNC-7 guidelines.[20]

Definition and determination of MetS: MetS is defined as a pathological condition including a group of risk factors for CVDs, DM, and obesity. Its characteristic findings are abdominal obesity, atherogenic dyslipidemia (elevated triglyceride and low HDL cholesterol levels), raised blood pressure, insulin resistance (with or without glucose intolerance), and prothrombotic and proinflammatory states.

Diagnosis of MetS was made based on the presence of three or more of the following ATPIII criteria; fasting-glucose, (FG) ≥110 mg/dl; triglyceride (TG), ≥ 150 mg/dl; High density lipoprotein (HDL), <50 mg/dl for women, and<40 mg/dl for men; WC >88cm for females, and> 102 cm for males; and SBP, ≥130 mmHg; or DBP, ≥85 mmHg.[19]

Questionnaires

PASI: It is the golden standard for determining PS-severity using expansion and morphological features of the lesions, between the scores of 0 and 72.[10]

PQoLI: It is a scale detecting QoL in PS-patients, which was developed by Aydemir et al. in 2003. It consists of 17 questions with three subtitles, which includes clinical findings, social/sexual lives, and use of PS-specific drugs of patients. As score increases, QoL is adversely affected.[8]

PSQI: It is a self-administered survey measuring SQ during previous month. It consists of 19 questions for patients, and additional 5 questions answered by their bed partner (if exist). Answers are evaluated in the range of 0-3 points. The questionnaire includes the following components; subjective-SQ (SSQ), sleep-latency (SL), habitual sleep-efficiency (HSE), sleep-duration (SDu), sleep-disturbances (SDi), use of sleeping medication (USM) and day-time sleep-dysfunction (DSD). A total score ≥ 5 indicates bad SQ. Its validity and reliability were made by Agargun *et al*.[11]

BAI: It is a 21-item inventory evaluating the symptoms of anxiety; each of them describes a different ANX state. Total score can be in the range of 0-63, Higher scores indicate higher ANX. Its reliability and validity were made by Ulusoy *et al*.[13]

BDI: It is a 21-item inventory; each of them are scored on a 4-point Likert scale to question DEP. The total score may change between 0 and 63. Higher scores indicate higher DEP. Hisli performed its reliability and validity.[12]

PSS: It is used to evaluate stress perception of the persons. It has 14 items; each is scored on a 5-point Likert scale. Total score can be between 0 and 56. Perception of stress increases as the score increases. It is developed by Kamarck and Mermelstein in 1983, whereas Eskin et al made its reliability and validity.[14]

BIQoLI: It was developed by Cash and Fleming in order to determine the effect of body image (BI) on the life of persons, and was adapted to our population by Demiralp *et al*. It consists of 19 items which are rated between +3 and -3. Higher scores indicate improved QoL.[15]

FS: It was developed by Diener and was adapted to our population by Telef, in 2013. It consists of 8 items, which are rated from 1 to 7. Higher scores indicate higher resources and power of a person. Total score may range from 8 to 56.[16]

TEES: Turkish Emotional Eating Scale was developed by Bilgen in 2018, in order to examine eating behaviors of a person in relation to the mood. It is a 5-point Likert-scale which contains 30 items. Scores may range from 30 to 150. Higher scores indicate a high tendency to exhibit EDs.[17]

SAAS: It was developed by Hart *et al*. in 2008, in order to detect persons' social appearance concerns, and adapted to Turkish population by Doğan, in 2010. It is a 5-point Likert-scale consisting of 16 items. Scores may change between16 and 80. Higher scores indicate higher visibility concerns.[18]

Laboratory analysis

FG, HDL and TG levels were analyzed using Automated Enzyme Immunoassay (Roche cobas 8000-702, Roche Diagnostics, Rotkreuz, Switzerland).

Statistical analysis

All data were analyzed using Statistical Package for Social Sciences (IBM SPSS Statistics, version 24, New York, USA, 2016, for MAC). Standard descriptions were expressed as mean, standard deviation (SD), median (mean) or percentage (%). The normality assumption of the variables was checked using Kolmogorov Simirnov test. Student-t test was used to compare the values which were distributed normal, whereas Mann-Whitney U non-parametric analysis was used for asymmetric ones. Comparison of qualitative data was evaluated with Pearson Chi-square test and Fisher's exact chi-square test according to frequencies of variables. Spearman's rho test was used to determining in relations of dependent and independent variables which were distributed

asymmetric. A p-value of <0.05 was considered to be significant. Results were determined with 95% confidence.

RESULTS

A total of 107 subjects (50 F & 57 M) completed the study. Comparison of means of demographics, PS-duration, meaningful MetS criteria (WC and BMI), and comorbidities by MetS groups are seen in Table 1. Mean age of study population was 46.28±13.95 years. It was significantly higher in MetS (+) group (p=0.018). Sixty-eight subjects were diagnosed with MetS. PS-duration, WC, and BMI, were higher in MetS (+) group. HT and DM were also more detected in this group. FG, TG and HDL values did not differ statistically between the two MetS groups.

Comparison of means of PASI, PQoLI, PSQI and its subcomponents, and psychological scales by MetS groups are seen in Table 2. There was no difference between their means by MetS (+) and MetS (-) groups.

Correlation of means of PASI with the means of PQoLI, psychological scales, PSQI and its subgroups by whole group and MetS groups are seen in Table 3. PASI significantly correlated with PQoLI, BDI, BAI, PSQI, HSE, SDu and USM in whole group. Significantly positive correlations were found between PASI scores and, PQoLI, BAI, PSQI, HSE and SDi values, and negative correlation with FS in MetS (+) group. PASI

Table 1: Comparison of the means of demographics, PS-duration, meaningful MetS criteria (WC and BMI), and comorbidities by MetS groups

N Total=107		**MetS (-) (n:39)**	**MetS (+) (n:68)**		
Variables		**Mean±SS (Median)**	**Mean±SS (Median)**	**t/U**	**p**
[a]**Age (year)**		42.10±14.50(40)	48.67±13.13(49)	-2.398	0.018*
[a]**Duration (year)**		8.66±4.57(8)	13.61±8.45(12.5)	781.50	**<0.001****
[b]**WC (cm)**		99.10±13.47 (100)	109.62±14.03 (111.5)	741.50	**<0.001****
[b]**BMI (kg/m2)**		28.42±5.16 (27.8)	31.11±5.96 (30.6)	944.00	**0.013***
		N(%)	**N(%)**	**χ2**	
[c]**Gender**	Female	16 (41.0)	34 (50.0)	0.802	0.424
	Male	23 (59.0)	34(50.0)		
[c]**Marital status**	Unmarried	8 (20.5)	6(8.8)	2.978	0.084
	Married	31 (79.5)	62(91.2)		
[++]**Educationn**	Illiterate	1 (2.6)	1 (1.5)	1.357	0.756
	Primary school	16 (41.0)	30 (44.1)		
	High school	13 (33.3)	26 (38.2)		
	University	9(23.1)	11(16.2)		
[c]**HT**	Absent	37(94.9)	37 (54.4)	19.022	**<0.001****
	Present	2(5.1)	31 (45.6)		
[c]**DM**	Absent	27 (69.2)	32 (47.1)	4.926	**0.026***
	Present	12 (30.8)	36 (52.9)		
[c]**TD**	Absent	36 (92.3)	57 (83.8)	1.387	0.545
	Hypothyroidism	2 (5.1)	6 (8.8)		
	Hyperthyroidism	1(2.6)	5 (7.4)		

[a]*Student t Test*. [b]*Mann Whitney U Test*. [c]*Chi-square Test*. [++]*Fisher Exact chi-square Test*. *p<0.05. **p<0.01

MetS: Metabolic syndrome; HT: Hypertension; WC: Waist circumference; DM: Diabetes mellitus; BMI: Body mass index; TD: Thyroid disease

Table 2: Comparison of means of PASI, PQoLI, PSQI and its subgroups, and psychological scales by MetS groups

N=107	MetS (-) (n:39)	MetS (+) (n:68)		
Variables	**Mean±SS (Median)**	**Mean±SS (Median)**	**U/t**	**p**
PASI	17.39±17.786(10.5)	23.48±17.22 (24.0)	1027.50	0.053
PQoLI	26.00±14.90 (28)	31.01±12.57 (34)	1047.50	0.071
PSQI	8.69±4.04(8)	9.16±4.24(8)	1271.00	0.721
SSQ	1.92±0.73(2)	1.72±0.75(2)	1124.00	0.156
SL	1.51±0.94(1)	1.72±0.92(2)	1160.50	0.261
HSE	1.21±0.14(1)	1.23±1.17(1)	1133.50	0.576
SDu	1.23±1.15(1)	1.17±1.10(1)	1295.50	0.837
SDi	0.53±0.88(0)	0.79±1.04(0)	1169.50	0.253
USM	1.64±0.58(2)	1.75±0.69(2)	1234.50	0.513
DSD	0.51±0.82(0)	0.45±0.88(0)	1229.00	0.421
BDI	20.20±11.43 (18)	23.36±12.59 (20)	1143.50	0.237
BAI	19.43±12.43 (18)	21.62±13.71 (19)	1214.00	0.468
[a]FS	35.53±11.71(34)	34.08±11.58(34)	0.621	0.536
TEES	72.56±25.40(66)	79.80±26.70(87)	1135.00	0.216
PSS	30.25±6.40(31)	30.91±8.48(32)	1251.50	0.629
SAAS	47.84±17.48(51)	49.41±17.89(50)	1250.50	0.625
[a]BIQoLI	10.28±26.15 (11)	5.54±27.72 (6)	0.868	0.380

Mann Whitney U Test. [a]*Student t Test.*
MetS: Metabolic syndrome; USM: Use of sleeping medicationl; PASI: Psoriasis area severity index; DSD: Daytime sleep duration; PQoLI:Psoriasis quality of life index; BDI: Beck depression index; PSQI: Pittsburgh sleep quality index; BAI: Beck anxiety index; SSQ: Subjective sleep quality; FS: Flourishing scale; SL: Sleep latency; TEES: Turkish emotional eating scale; HSE: Habitual sleep efficiency; PSS: Perceived Stress scale; SDu: Sleep duration; SAAS: Social appearance anxiety scale; SDi: Sleep disturbance; BIQoLI: Body image quality of life index

positively correlated with only PQoLI and PSQI in MetS (-) group.

Correlation of PQoLI with psychological scales and SQ indexes in whole group and different MetS groups are seen in Table 4. PQoLI was positively correlated with BDI, BAI, PSQI, SSQ, SL, HSE, SDi and USM in whole group. It was positively correlated with BDI, BAI, PSQI, SSQ, SDi and DSD, whereas negatively correlated with BIQoLI in MetS (+) group. No correlation was detected with PQoLI in MetS(-) group.

DISCUSSION

PS is a chronic immune-mediated skin disease, which leads to many comorbidities such as arthritis, obesity, HT, dyslipidemia, DM, ANX, and DEP. MetS is another multisystem disease which may be associated with these disorders.[1,2] Kozan *et al*. reported that the prevalence of MetS was 33.9% (28% in men and 39.6% in women) in our population.[21] MetS development in PS-patients has increasingly been reported in recent years.[1,2]

Altunay *et al*. stated that MetS prevelance was 31% with a male dominance in PS-patients. [1]Our prevalence (63.5%) was cosiderably higher than those found in these studies, with an absence of a gender dominance (50% for each gender). Obtained results were consistent with the literature, which predicts that MetS will gradually increase in both genders in the coming years.[1-3]

MetS development can be affected from PS duration or severity.[1,2] In present study PS-severity did not show significant difference by MetS groups similar to Altunay *et al*.'s study. But, PS-duration was significantly longer in MetS (+) group.

Another remarkable finding in our study was that only WC and BMI differed from MetS criteria between the groups. Moreover, FG, TG and HDL did not show significant differences

Table 3: Correlation of means of PASI with the means of PQoLI, psychological scales, PSQI and its subgroups by whole group and MetS groups

N Total=107		Whole group PASI N=107	MetS (+) group PASI N=68	MetS (-) group PASI N=39
PQoLI	**r**	**0.634****	**0.805****	**0.499****
	p	<0.001	<0.001	<0.001
BDI	**r**	0.208	0.166	0.232
	p	0.032	0.313	0.056
BAI	**r**	**0.266****	**0.318***	0.228
	p	0.006	0.049	0.061
FS	**r**	-0.085	**-0.319***	0.076
	p	0.384	0.047	0.537
TEES	**r**	0.02	0.001	-0.022
	p	0.835	0.994	0.859
PSS	**r**	0.03	0.045	0.054
	p	0.757	0.999	0.662
SAAS	**r**	0.087	0.135	0.059
	p	0.375	0.412	0.635
BIQoLI	**r**	-0.074	-0.052	-0.069
	p	0.45	0.752	0.575
PSQI	**r**	**0.327****	**0.459****	**0.260***
	p	0.001	0.003	0.032
SSQ	**r**	0.119	0.207	0.133
	p	0.151	0.184	0.279
SL	**r**	0.122	0.222	0.153
	p	0.107	0.175	0.213
HSE	**r**	**0.318****	**0.528****	0.108
	p	0.001	0.001	0.381
SDu	**r**	**0.203***	0.269	0.159
	p	0.036	0.098	0.195
SDi	**r**	0.168	**0.517****	0.159
	p	0.083	0.001	0.195
USM	**r**	**0.328****	0.117	0.096
	p	0.001	0.477	0.436
DSD	**r**	0.099	0.234	0.153
	p	0.309	0.151	0.212

*Spearman's rho correlation.*p<0.05. **p<0.01*

MetS: Metabolic syndrome; PSQI: Pittsburgh sleep quality index; PQoLI: Psoriasis quality of life index; PQoLI: Psoriasis quality of life index; SSQ: Subjective sleep quality; BDI: Beck depression index; SL: Sleep latency; BAI: Beck anxiety index; HSE: Habitual sleep efficiency; FS: Flourishing scale; SDu: Sleep duration; TEES:Turkish emotional eating scale; SDi: Sleep disturbance; PSS: Perceived Stress scale; USM: Use of sleeping medication; BIQoLI: Body image quality of life index; DSD: Daytime sleep duration

Table 4: Correlation of PQoLI with psychological scales and SQ indexes by study groups

Group				**Whole**		**N=107**										
SCALES		**BIQoLI**	**BDI**	**BAI**	**FS**	**TEES**	**PSS**	**SAAS**	**PSQI**	**SSQ**	**SL**	**SDu**	**HSE**	**SDi**	**USM**	**DSD**
PQoLI	**r**	-0.126	**0.232****	**0.241****	-0.159	0.138	0.019	0.176	**0.300****	**0.247***	**0.229***	0.113	**0.222***	**0.242***	**0.198***	0.042
	p	0.195	0.007	0.009	0.102	0.158	0.845	0.070	0.002	0.01	0.018	0.245	0.021	0.034	0.041	0.668
Group				**MetS (-)**		**N=39**										
PQoLI	r	0.224	0.167	0.261	-0.430	0.196	0.070	0.231	0.143	0.145	0.1	0.266	0.266	0.017	-0.009	0.224
	p	0.171	0.310	0.109	0.062	0.231	0.674	0.158	0.384	0.377	**0.545**	**0.102**	**0.102**	**0.919**	0.957	0.171
Group				**MetS (+)**		**N=68**										
PQoLI	r	**- 0.358****	**0.320****	**0.292****	-0.058	0.062	0.013	0.169	**0.335****	**0.258***	0.132	0.167	0.167	**0.296***	0.110	**0.368****
	p	0.003	0.008	0.016	0.638	0.614	0.914	0.168	0.005	0.033	0.282	0.174	0.174	0.014	0.370	0.024

*Spearman's rho correlation.*p<0.05. **p<0.01*

MetS: Metabolic syndrome; PSQI: Pittsburgh sleep quality index; PQoLI: Psoriasis quality of life index; SSQ: Subjective sleep quality; BDI: Beck depression index; SL: Sleep latency; BAI: Beck anxiety index; HSE: Habitual sleep efficiency; FS: Flourishing scale; SDu: Sleep duration; TEES:Turkish emotional eating scale; SDi: Sleep disturbance; PSS: Perceived Stress scale; USM: Use of sleeping medication; BIQoLI: Body image quality of life index; DSD: Daytime sleep duration

although the presence of DM and HT was different. This findings were unexpected and seemed contradictory, because the definition of MetS depends on which parameters are present.

However, Guenther *et al.* indicated that hyperleptinemia was significantly associated with PS, independent of BMI, HT and presence of MetS, in PS patients with MetS.[4] Similarly, our findings showed that BMI and WC criteria might come to the fore in PS patients, independent of the diagnosis of MetS and other MetS criteria. The authors mentioned the importance of adipose tissue cytokines in the development of MetS in PS patients.[4] So, we suggest that MetS may develop through subcutaneous adipose tissue-originated cytokines, and these factors may cause BMI and WC come to the fore in PS patients.

On the other hand, SDs are significant predisposing factors in the development of chronic inflammatory diseases with the deterioration in QoL.[2,6] Although the average rate of SDs in PS-patients is not exacly known, it has been reported to be between 0.05% and 77.1%.[22] Emotional factors have been suggested as possible indicators that may lead to develop SDs in PS-patients. Moreover, SDs may be triggrering factors for the activation of PS.[2,6] PS-patients have worse SQ compared to healthy controls, which has been associated with their increased of ANX, DEP and pruritus levels.[7,23]

The link between SQ and PS which is thought to be bidirectional, is tried to be explained by common inflammatory mechanisms. Worsened SQ may lead to secretion of proinflammatory cytokines and decreased anti-inflammatory ones in the epidermis, and finally, some metabolic and endocrine disorders may be triggered thanks to the changed environmental cytokines.[6] Wong *et al*. pointed out the negative effects of SDs on PS-patients, and this relationship has been associated with their fatigue, high ANX levels and skin disease related poor QoL.[23]

Conversely, Stinco *et al*. did not show a difference between the SQ values of PS-patients and healthy controls.[22] In the present study, PS-severity showed significant correlations with impaired overall-SQ independent of the presence of MetS. PS-severity was correlated with impairing in some sleep-subcomponents such as HSE, SDu, USM in whole group, whereas it was correlated with HSE and SDi in MetS (+) group. However, no correlation was found in MetS (-) group.

So, it was thought that the development of MetS may be related with the distortion in certain sleep-subcomponents in PS-patients, or vice versa. But, we could not find enough literature to compare the individual effects of the sleep-subcomponents in the development of MetS in PS-patients.

Only, Sahin *et al*. stated that overal SQ and SDu were worse in PS-patients than healty controls, but especially SSQ, SL, SDi and DSD sleep-subcomponents were impaired in the PS-patients with pruritus than the others without pruritus.[25]

However, their study did not address the presence of MetS. Moreover, the prevalence of pruritus in PS are limited and contradictory, and it occurs especially in "erythrodermic" and "palmoplantar " variants.[26] Our all subjects had chronic plaque-PS, and the most of them did not complain of itching, so we did not include this factor in our evaluations.

On the other hand, PS has undesirable negative effects on patients' QoL with the physical, social and psychological burdens of the disease.[7] It is considered that outer aspect of the body is important factor for persons' psychological health and it has key role in people's attitudes and behaviors towards their own bodies and lives. Thus, undesirable visuality and recurrent course of PS-lesions are held responsible for the psycho-dermatological adverse effects of PS.[27]

Stigmatization caused by poor skin appearance leads to long-lasting mental restrictions and difficulties in emotion regulation that result in decrease in social adaptation, self-perception, self-esteem, impaired health-related QoL, ANX, and DEP.[3] Amanat *et al*. showed that many of PS-patients may exhibit certain psychopathologies such as ANX, DEP, bipolarity in mood, sexual disorders, SDs, EDs and also psychosis.[28] Although there is not enough evidence for humans, it has been showed in animal models that stressful conditions creates important damages in cutaneous permeability in PS, and exacerbation of PS followed by a stressful condition was related with increased pro-inflammatory neuropeptide production.[29,30]

Moreover, Breuer *et al*. stated that PS-patients exposed to chronic stress and burnout syndrome had appreciable negative impacts in their QoL.[31] In the present study, although the means of ANX and DEP were higher the treshold values of them, no difference was found between MetS groups.

Similarly, whole subjects had poor PQoLI scores, which were positively correlated with PS-severity in both MetS groups, however the difference between MetS groups was insignificant.

BI is another psychological and multidirectional concept including feelings, attitudes and

behaviours towards own body of persons, which may begin to change when they complained of any skin disease. Because PS lesions have unpleasant-looking, they may lead to a distortion in BI.[2,3,27] Rosinska *et al*. showed that BI was worse especially in females with PS, which was correlated with DEP.[3] Although the means of BI-related QoL were worse in our subjects with MetS, the difference between two MetS groups was insignificant, and no difference was detected by genders. It was thought that this indifference might be stemmed from due to the relative small numbers of subjects in both MetS groups.

Moreover, flourishing is a condition which is related with well-being of a person, and it is adversely associated with mood disorders.[16] In the present study, means of flourishing did not show a difference by MetS groups, whereas it was negatively correlated with PS-severity in only MetS (+) group.

Additionally, impaired PS-related QoL was positively correlated with BIQoLI, BDI and ANX values in only MetS (+) group, but not in MetS (-) group. So, it was thought that these psychopathologies developing in long-term PS, could lead to additional burdens on the PS-related QoL and trigger the development of MetS.

Furthermore, it is expected that perception of the stress is naturally increased in PS-patients because of increased psychological burden caused by their poor skin appearance. However, Ahdout et al. showed that perceived stress was not different in PS-patients with MetS compared to healthy controls.[32] In the present study, although the mean of perceived stress was slightly higher in MetS (+) group than the Mets (-) group, no significant difference was found by the groups.

Social ANX was reported as another frequently detected psychological condition in PS-patients because of increased ANX which is caused by a stigmatization associated with poor skin appearance. Schneider *et al*. reported that social ANX and avoidance were seen significantly high in PS-patients.[33] Similarly, social ANX was detected at a pretty high level in our whole group, however difference between the groups was insignificant.

Furthermore, EDs are pathological eating behaviours, which may be associated with psychological disorders such as ANX and DEP.[1,5] EDs and especially BED have been suggested to be significantly effective in the development of obesity and subsequently MetS in PS-patients through ANX and DEP.[1,6] Although mean scores of TEES were quite high in MetS (+) group, the difference by the groups was insignificant.

Present study is a pilot study aiming to determine the roles of EDs, SQ and certain psychopathologies in the possible development of MetS in PS-patients through PSQoL. Although the absence of difference in comparison of PSQoL means by MetS groups, detection of significant correlations between PSQoL and certain psychopathologies and SQ only in MetS (+) group, was thought to be age and time-dependent potential mediating roles of neuropsychogenic factors in the development of dysmetabolic consequences in PS-patients.

Another remarkable result is that some diagnostic criteria such as BMI and WC may come to the fore in MetS development in PS patients. This seems to be in line with the literature on the importance of adipose tissue-derived cytokines in PS patients.[4]

Given the gradually expanding perspective of the concept of MetS, obtained results are striking enough to reveal the importance of neuropsychogenic factors in the development of this disease by impairing QoL, as well. Nevertheless, long-term and broad-based studies are needed to elucidate this interaction.

Present study have some limitations that are relatively small sample size, being a single center study, inequality in the subject number in MetS groups and the absence of a control group, which were caused by the difficult conditions during COVID-19 Pandemic. Another limitation is that only patients with plaque-PS were included. Obtained insignificant results in the comparison of means may also rise concerns. However, both PS and MetS can highly be influenced from SDs, EDs and psychopathologies individually[1,34], so these indifferences in the comparisons might be stemmed from that reason. Additionally, despite the presence of significant differences in the mean-age and disease duration, and the absence of any difference in the comparison of the other means (except for own diagnostic criteria of MetS) by the groups, obtained significant correlations between the PSQoL and neuropsychogenic factors only in MetS (+) group are also remarkable.

In conclusion, the presence of MetS is found at high-rate among PS-patients, which is mainly associated with PS-duration and increasing age. BMI and WC may come to the fore in MetS development in these patients, possibly due to the subcutaneous fatty tissue-derived cytokines involved in the pathogenesis of PS. Neuropsychogenic factors such as poor-BI, DEP, ANX and SDs may have facilitating roles

in dysmetabolic developments, by deteriorating PS-related QoL in PS-patients.

DISCLOSURE

Conflict of interest: The authors do not declare any conflicts of interest.

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