Archives of Psychiatry and Psychotherapy Online First Nr 28: 1–9

10.12740/APP/177247

The psoriasis severity, dermatology life quality index and sleep quality: The role of itch intensity and depression

Karolina Wrzosek-Dobrzyniecka, Romana Kadzikowska-Wrzosek, Aneta Szczerkowska-Dobosz

Abstract

Background and objective. Numerous studies confirm that sleep disturbances are common in psoriasis. However, the impact of psoriasis severity on low sleep quality is still unclear. To better understand the origin of sleep quality impairment among psoriasis patients, we sought to examine whether the psoriasis severity, health related life quality, itch and depression are significant predictors of sleep disruption; and whether itch intensity and depression are mediators of the relationship between the health – related life quality and sleep problems.

Materials and Methods. 42 patients diagnosed with chronic plaque psoriasis, (female: 40.5%; mean age=44.48 years; SD=17.57, age range=21-82) completed Polish versions of: the Pittsburgh Sleep Quality Index (PSQI), the Centre for Epidemiological Studies – Depression scale (CES-D). The itch intensity was measured according to the 10-point visual analogue scale (VAS). The Severity of patient's psoriasis was evaluated by using The Psoriasis Area Severity Index (PASI), health related life quality was assessed using the Dermatology Life Quality Index (DLQI) .

Results. The stronger the negative effect of psoriasis on patients' life as measured by Dermatology Life Quality Index, the greater the sleep disturbances. The results confirm that poor health – related quality of life may account for higher sleep ditrubances among psoriasis patients, and suggest that this negative effect reveals itself, through enhancing depression.

Conclusion.It seems that a greater therapeutic focus on health related quality of life in psoriasis patients may lead to an improvement in their sleep quality.

psoriasis; health – related quality of life; sleep disturbance; itch, depression

Research reports consistently confirm that sleep disturbances are prevalent issue among patients with psoriasis [1-9]. Psoriasis, both directly – due to skin symptoms (primarily itching), and indirectly – due to comorbidities (including depression), contributes to sleep problems [1-3,7-8]. Although previous studies showed in inconclusive manner the influence of psoriasis severity on sleep, the relationship between the severity of psoriasis and sleep problems is unclear. It is still being questioned whether more severe psoriasis leads to more sleep disturbance [10-13]. Some results indicate that the patients' health-related quality of life is more important for sleep problems than objective diagnosis of the psoriasis' severity [8,11,14].

Karolina Wrzosek-Dobrzyniecka[1], Romana Kadzikowska-Wrzosek[2], Aneta Szczerkowska-Dobosz[3]: [1]Medical University of Gdańsk, Poland; [2]Institute of Psychology, SWPS University, Sopot, Poland; [3]Depertament of Dermatology, Venereology and Allergology, Medical University of Gdańsk, Poland
Correspondence address: rkadzikowska-wrzosek@swps.edu.pl

In clinical trials, it is commonly used objective measures of psoriasis' severity, such as the extent of surface area affected or the psoriasis area severity index. However, these objective measures do not take into account the impact of the disease on the patients' lives. Psoriasis significantly affects many spheres of life and the patients' quality of life, being a source of serious stress. In psoriasis, mental stress is likely related to a combination of physical and social factors. On the one hand, the symptoms of the disease are the source of stress, and on the other hand, stress is also caused by the chronic and complicated treatment and social perception of psoriasis. It is currently accepted that the assessment of a patient's health condition cannot be based solely on objective measures of psoriasis severity. Among other things, it is recommended to evaluate the effectiveness of psoriasis treatment both on the basis of changes in the severity index and dermatology life quality index [14-18].

Pruritus, which is observed in the vast majority of patients, has a direct impact on sleep problems in psoriasis. Itching in psoriasis patients appears or worsens in the evening and interferes with sleep. At the same time, it is emphasized that the development of serious sleep problems in psoriasis patients is largely determined by psychological factors, such as depression or habits related to the regulation of sleep-related behavior. This may be the reason why there is such a large variation in the severity of insomnia in psoriasis. In other words, sleep disruption caused by itching does not always lead to problems as severe as insomnia [1,19-21].

People with psoriasis are often depressed. Moreover the prevalence of depression is significantly higher in psoriasis than in other dermatological diseases [2,11,22-26].The sleep-disruptive effect of depression is well known and well-established [27]. Some studies show that sleep problems are secondary to depression in psoriasis. In other words, mainly depression, and not any other disease process associated with psoriasis contributes to sleep problems. At the same time, it is noted that the relationship between depression and psoriasis is still not well understood. This relationship is likely to bidirectional. Research shows that people with depression very often suffer from psoriasis, and on the other hand, psoriasis is considered a contributing factor to depression[22-26,28-33]. Existing data also confirm the relationship between depression and the intensity of the itching sensation in patients with psoriasis. Additionally, treatment of depression has been shown to reduce itching in psoriasis patients [34].

The question remains to what extent the severity of psoriasis itself contributes to the development of sleep problems in patients, and to what extent the patients' sleep disturbances are a consequence of the negative impact of psoriasis on their quality of life. It is also important to explain the role of disease-related symptoms such as pruritus and comorbidities such as depression in the relationship between the severity of psoriasis, dermatology life quality index, and patients' sleep quality.

The current study has two major goals:

1. To find out whether the psoriasis severity, dermatology life quality index, itch and depression are significant predictors of patients' sleep quality. An additional goal was to compare the impact of the psoriasis severity and dermatology life quality index on patients' sleep quality.
2. To examine whether itch intensity and depression are mediators of the relationship between the psoraisis severity, dermatology life quality index and patients' sleep quality. It was assumed that the dermatology life quality index would be a stronger predictor of sleep disorders than the severity of psoriasis itself. It was also expected that including itch intensity and depression in the analyses would shed some new light on the link between the psoraisis severity, dermatology life quality index and patients' sleep quality.

1. MATERIALS AND METHODS

1.1. Participants

The study was conducted anonymously, using paper form of questionnaire and including clinical assessment of psoriasis severity. The participants gave their informed consent to participate in the study. The research was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki "Ethi-

cal Principles for Medical Research Involving Human Subjects", (amended in October 2013). All patients involved in our study, attending the outpatient clinic at the Department of Dermatology, Venereology and Allergology, Medical University of Gdansk. We included patients aged > 18 years without other dermatological inflammatory diseases and with lack of another organic disorders which could induce sleep problems or depression symptoms. Additionally we excluded patients who were unable to understand the questions or were unwilling to fill the questionnaire. Individuals were also excluded if they were receiving treatment for a sleep disorder.

1.2 The psoriasis severity

Psoriasis severity was assessed with the Psoriasis Area and Severity Index (PASI)[37] PASI score ranges from 0 to 72 and relates to the severity of clinical signs in the skin areas involved. Mild psoriasis is characterized by PASI scores < 10 and moderate-to-severe type can be observed with the score > 10 [15,35-36].

1.3. Itch intensity

Itch intensity was measured according to the 10-point visual analogue scale (VAS), with a higher score indicating more severe pruritus. Study participants were asked to assess itch intensity over the last month [37].

1.4. Depression

Depressive symptoms were assessed with the Centre for Epidemiological Studies – Depression scale (CES-D). CES-D consists of 20 items with scores ranging from 0 (no depressive symptoms) to 60 (maximum depressiveness) and covers four components of depressive symptomatology: somatic symptoms, depressed affect, positive affect and interpersonal relations [38].

1.5. Health-related life quality

The assessment of the effect of skin disease on an individual's quality of life was performed by using dermatology life quality index (DLQI). DLQI scores: 0 to 1 no effect at all on patient's life, 2 to 5 small effect on patient's life, 6 to 10 moderate effect on patient's life, 11 to 20 very large effect on patient's life, 21 to 30 extremely large effect on patient's life [15,39].

1.6. Sleep quality

Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI) [40]. The PSQI consists of 19 items ranked among 7 components related to sleep quality and disturbance over 1 month: sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications and daytime dysfunction. All the above are summed to yield a global sleep quality score ranging from 0 to 21. A score of ≤ 5 indicates normal sleep, while ≥ 6 is evidence of poor sleep.

1.7. Procedure

All individuals participating in the study met individually with the researcher. After receiving information explaining content and aim of the study and agreeing to participate in the study participants proceeded to filling in the questionnaire. The questionnaire consisted of five parts. In the first section we collected demographic data and medical history information. In parts two to five we measured variables such as: itch, depression, dermatological quality of life and sleep quality. The researcher assessed the severity of psoriasis based on the Psoriasis Area and Severity Index.

2. RESULTS

2.1. Sample characteristic

A total of 42 patients with chronic plaque psoriasis (40.5% of females; mean age=44.48 years; *SD*=17.57, age range=21-82) were included in the study. The mean age of the first psoriasis outbreak in the study group was 27 years (*SD* = 18.28), the earliest psoriasis appeared in 1 year of life (2.4%), and at the latest in 75 years of age (2.4%). According to the PASI scores,

55.5% of individuals had mild psoriasis (PASI <10) and 40.5% of them had moderate to severe psoriasis (PASI> 10). On the other hand, according to the criteria assumed in the DLQI scale: 16,7% of the respondents did not feel the negative impact of the disease (DLQI from 0 to 1); 23.8% experienced a slight reduction in the quality of life (DLQI 2 to 5); 23.8% of respondents had a moderately reduced quality of life (DLQI from 6 to 10), 33.3% of patients had a significant reduction in quality of life (DLQI from 11 to 20), and one person (2.4%) had a DLQI = 30, which indicates a very strong and unfavorable influence of the disease on the quality of life. 64.3% of the studied patients, i.e. the vast majority of patients were hospitalized for psoriasis at least once, and only 35.7% were never hospitalized.

The range of BMI in the study group was from 19 to 42, mean BMI = 27.72; SD = 5.03; only 26.2% of the respondents were normal weight (BMI <25), 50% were overweight (BMI> 25 and <30), 11.9% were classified as I class obesity (BMI> 30 and <35), 7.1% of patients had diagnosed with II class obesity (BMI> 35 and <40) and one patient (2.4%) had III class obesity, BMI = 42.

Our research confirmed that the majority of individuals 64.3% (N = 27) suffered from sleep problems (these respondents obtained a PSQI result above 6 points). According to the criteria proposed by Weissman et al. [41] 56.3% of the respondents did not have depression (CES-D overall score <16), 16.5% showed mild or moderate level of depression (16-21 points, overall score on the Scale CES-D), whereas 27.2% of respondents experienced severe depression (> 21 points overall score on the CES-D Scale).

2.1. STATISTICAL ANALYSIS

Data was analysed using the Statistical Package for Social Sciences (SPSS 26.0). Table 1 contains the means and standard deviations. Table 2 presents intercorrelations of all the variables measured. The pattern of correlations between sleep quality, and the severity of psoriasis, and dermatology life quality index, and itching was in line with expectations. Higher sleep distrubances is linked to a more severe psoriasis, a higher dermatology life quality index and a greater feeling of itching. Sleep quality was negatively related to the level of depression symptoms. Results of correlation analyses indicated also positive correlation between ichting and BMI. As regards measures of severity of psoriasis and dermatology life quality index, they correlated highly with each other.

Table 1. Means and standard deviations of the analyzed variables: itch intensity, severity of psoriasis (PASI), dermatology life quality index (DIQI), sleep quality (PSQI) and depression (CES-D).

Variable	Mean (M)	Standard Deviation (SD)
ITCH INTENSITY	4.38	3.16
PASI	8.65	7.02
DLQI	8.59	6.85
CES-D	14.55	10.05
PSQI	6.88	3.16

PASI – Psoriasis Area and Severity Index, BSA – Body Surface Area, DLQI – Dermatology life quality index, CES-D – the Centre for Epidemiological Studies – Depression scale, PSQI – Pittsburgh Sleep Quality Index.

Table 2. Intercorrelations among all study variables: BMI, itch intensity, severity of psoriasis (PASI), dermatology life quality index (DIQI), sleep quality (PSQI) and depression (CES-D).

	1.	2.	3.	4.	5.	6.
1.BMI		0.39*	0.29	0.08	0.28	0.09
2.ITCH INTENSITY			0.71**	0.66**	0.58**	0.49**
3.PASI				0.74**	0.50**	0.52**
4.DLQI					0.49**	0.68**
5.PSQI						0.58**
6.CES-D						

BMI – Body mass index, PASI – Psoriasis Area and Severity Index, DLQI – Dermatology life quality index, PSQI – Pittsburgh Sleep Quality Index, CES-D – the Centre for Epidemiological Studies – Depression scale.

*p > 0.05. ** p< 0.01 (all two-tailed significance tests).

Table 3 provides information on the results of regression analyses for sleep quality. Hierarchical multiple regression analysis was performed to assess the impact of gender, age, BMI, severity of psoriasis, dermatology life quality index, itch intensity and depression. In the first step, the demographic variables gender (coded 0 = female, 1 = male), age and BMI were entered, followed, in the second step, by severity of psoriasis. In the third step dermatology life quality index was added and in the fourth step the itch intensity was included and in the fifth final step was added depression.

The results presented in Tables 3 indicated that the demographic variables (gender and age) and BMI account for a statistically significant proportion of the variance in sleep quality R^2= 0.35, p<0.01; F(3.38)=6.70. Entering severity of psoriasis in step 2 resulted in a statistically significant increment in the explained variance R^2 =0.15, p < 0.01; F(4.37) = 9.02. Similarly, adding dermatology life quality index in step 3 significantly improved the model R^2=0.06, p<0.05;F(5.36)=8.90. When the itch intensity was added to the model, the change in explained variance was not significant. The change of the explained variance from the fourth to the fifth model, after adding depression in turn was significant: R^2=0.07, p<0.05;F(6.35)=8.27.

The examination of beta weights indicated that gender and age had significant negative beta weights (β = −0.51, p < 0.01 and β = −0.35, p < 0.05, respectively). BMI Index had significant positive beta weights (β = 0.36, p < 0.05.) Thus, female gender, younger age and higher BMI Index are significant predictors of greater sleep distrubances among psoriasis patients. The severity of psoriasis (β = 0.41, p < 0.01) is an important predictor of sleep distrubances. The greater the severity of psoriasis, the greater the sleep disturbance. Dermatology life quality index (β = 0.37, p < 0.01) is also a significant predictor of sleep disturbances in patients with psoriasis. The greater the effect of skin disease on an patient's quality of life, the greater the sleep disturbance. Depression (β = 0.37, p < 0.01) was a very significant predictor of sleep disturbances in the study group.

Table. 3 Results of hierarchical multiple regression of sleep quality on demographic variables, BMI, severity of psoriasis (PASI), dermatology life quality index (DLQI),itch intensity and depression (CES-D).

	Step 1	Step2	Step 3	Step 4	Step 5
	β	β	β	β	β ccccccccccc
Gender	– 0.51**	– 0.49***	-0.51***	-0.48***	-0.46***
Age	– 0.35**	– 0.25	-0.22	-0.25	-0.21
BMI	0.36*	0.20	0.24	0.18	0.16
PASI		0.41**	0.13	0.03	0.04
DLQI			0.37*	0,25	0.02
Itch intensity				0.30	0.26
CES-D					0.37*
R^2	0.29	0.44	0. 49	0.52	0.59
R^2 change	0.35**	0.15**	0.06*	0.03	0.07*

BMI – Body mass index, PASI – Psoriasis Area and Severity Index, CES-D – the Centre for Epidemiological Studies – Depression scale.
Note. All beta weights are standardized; all R2 values presented in the results are adjusted R2 values. *p<0.05 **p<0.01 ***p<0.001

Since the reduction of dermatology life quality index effect upon adding itch intensity and depression to the model suggested possible mediation, a bootstrapping procedure [45] was employed. The bootstrapping procedure based on 5000 bootstrapped resamples to estimate BC95% CI for indirect effect was used in order to examine the indirect effect of dermatology life quality index on sleep quality through the mediation of itching and depression. The PROCESS Procedure for SPSS Version 3.1 by Hayes, 2018 was used [42-43]. The multiple mediation models encompassed the following components: dermatology life quality index (independent varia-

ble), itch intensity and depression (simultaneous mediating variables) and sleep quality (dependent variable). In the analyzed model the specific indirect effects through itching was not significant (the 95% confidence interval ranged from –0.0047 to 0.0708). In turn the bootstrapped unstandardized indirect effect through depression was significant 0.13, and the 95% confidence interval ranged from 0.0432 to 0.2481 (Figure 1). Thus, in the multiple mediation model the effect of dermatology life quality index on sleep quality was fully mediated by depression.

Taken together, the results demonstrated that greater negative impact of psoriasis on patients' quality of life was significantly associated with higher levels of depression, which, in turn, predicted higher levels of sleep disturbances in these patients.

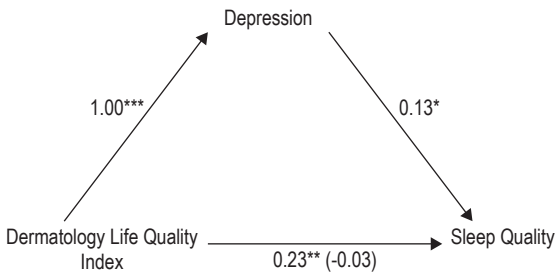

Fig. 1. The mediating effect of depression on the relationship between dermatology life qualities index (DLQI-Dermatology Life Quality Index) and sleep quality. Note: Path values represent understanding regression coefficients ***p<0.001; p<0.01; *<0.05

3. DISCUSSION

The present study confirmed previously reported findings of an occurrence of sleep problems among patients with psoriasis. Our results shown a prevalence of sleep disturbance, more than half of the patients participating in the research were characterized as poor sleepers. Moreover the results of our study confirmed that also in the group of Polish patients suffering from psoriasis, the psoriasis severity, patients' health – related quality of life and depression are significant predictors of sleep disturbances. In this way, our results supported findings from previous studies carried out in other countries [1-11,14-17]. Additionally, what's new with our findings is establishing the relationship between dermatology life quality index, depression and sleep disruption in psoriasis patients.

The conducted analyzes confirmed that, although the psoriasis severity is a significant predictor of sleep disturbance, the impact of psoriasis severity is no longer significant after adding the dermatology life quality index to the analysis. This means that the real significance for patients 'sleep problems is not so much the severity of psoriasis, but rather the impact of psoriasis on the patients' quality of life. This result may explain why studies do not always confirm the negative impact of the psoriasis severity on sleep quality. It also suggests that the assessment of a patient's health condition cannot be based solely on objective measures of psoriasis severity and the dermatology life quality index should be an important element of this assessment [15-16].

Our results showed no effect of pruritus on the quality of sleep in the study group, and at the same time confirmed that depression is the main mechanism by which patients' poor quality of life influences sleep disturbance. In other words, the results of the current study show that the patients' poor quality of life causes depression, which in turn negatively affects sleep. In this way, our investigation support previous findings showing that problems with sleep in psoriasis may be caused by the mediating effect of depression [2]. Thereby, we consider depressive symptoms as the most vital factor directly influencing sleep problems in psoriasis patients. The result indicating that pruritus did not affect sleep quality among patients is inconsistent with the results of other studies [19-21], so it may be due to the specificity of the study group. A full explanation of this discrepancy requires further research.

It is also worth mentioning that in the current study, demographic variables (age, gender, BMI), emerged as the predictors of sleep quality in individuals with psoriasis. These results are in accordance with the results of previous studies. It is well-established that, sex differences in sleep begin at a very early age. Also studies reported, that women experienced poorer sleep quality and had higher risk for insomnia than men [44-45]. Additionaly, we observed

a high prevelance of obesity in our sample. Only 26.2% of the respondents were normal weight (BMI <25). Should be noted that, that obesity is a known risk factor of obstructive sleep apnea (OBS) [46], which may interfere with both psoriasis and sleep [47-48]. Thus, the results of our study may be valuable to indicate group of psoriatic patients who are more susceptible to suffer sleep disturbance.

There are some limitations to this study that must be considered. Firstly research was limited by its sample size and lack of a control group, limiting our results on the causes of sleep problems found in analyzed group to generalize the psoriasis population as a whole. Secondly it should be noted that quality of sleep was measured only by subjective, self-reported methods without objective confirmation, which should be performed in further studies for better assessment of sleep disturbance. However it is relevant to emphasized that the Pittsburgh Sleep Quality Index has been found to be a valid and reliable measure of sleep disturbance [3,40] and self-report questionnaires are highly correlated with objective indicators of sleep quality [49-50].

4. CONCLUSIONS

Despite the above limitations, it should be concluded that our findings extend the available research on interaction between psoriasis and sleep as well as add supporting evidence to increased risk of experiencing sleep problems among psoriasis patients. Moreover, present results highlighted the effect of health – related life quality on sleep disturbances among patients with psoriasis. It can be considered that the present findings complement the previous observations suggesting one possible mechanism through which poor health – related quality of life in psoriasis may contribute to low sleep quality. As suggested by the current study, this mechanism primarily can involve the enhancement of depression.

Our findings clearly show that improving sleep in psoriasis patients requires a greater concentration of clinicians on the dermatology quality of life index, rather than just an objective assessment of the severity of psoriasis. Based on the results of the current study, it should be concluded, that pharmacological treatment of psoriasis should be combined with therapeutic psychological support of patients. The increased focus on the dermatology quality of life index could certainly improve the quality of patients' sleep and treatment of psoriasis.

REFERENCES

1. Gowda S, Goldblum OM, McCall WV, Feldman SR. Factors affecting sleep quality in patients with psoriasis. J Am Acad Dermatol. 2010;63(1):114-23.
2. Shutty BG, West C, Huang KE, Landis E, Dabade T, Browder B, et al. Sleep disturbances in psoriasis. Dermatology Online Journal. 2013;19(1).
3. Henry AL, Chisholm A, Carter LA, Bundy C, Griffiths CEM, Kyle SD. The relationship between sleep disturbance, symptoms and daytime functioning in psoriasis: a prospective study integrating actigraphy and experience sampling methodology. Sleep Medicine 72, 144-149.
4. Jensen P, Zachariae C, Skov L, Zachariae R. Sleep disturbance in psoriasis: a case-controlled study. Br J Dermatol. 2018;179(6):1376-1384.
5. Henry AL, Kyle SD, Chisholm A, Griffiths CEM, Bundy C. A cross-sectional survey of the nature and correlates of sleep disturbance in people with psoriasis. Br J Dermatol. 2017;177(4):1052-1059.
6. Wong ITY, Chandran V, Li S, Gladman DD. Sleep Disturbance in Psoriatic Disease: Prevalence and Associated Factors. J Rheumatol. 2017;44(9):1369-1374.
7. Henry AL, Kyle SD, Bhandari S, Chisholm A, Griffiths CEM, Bundy C. Measurement, Classification and Evaluation of Sleep Disturbance in Psoriasis: A Systematic Review. PLoS One. 2016;11(6):e0157843.
8. Gupta MA, Simpson FC, Gupta AK. Psoriasis and Sleep-Disorders: A Systematic Review. Sleep Med Rev. 2016;29:63-75.
9. Callis Duffin K, Wong B, Horn EJ, Krueger GG. Psoriatic arthritis is a strong predictor of sleep interference in patients with psoriasis. J Am Acad Dermatol 2009; 60: 604-8.
10. Melikoglu M. Sleep Quality and its Association with Disease Severity in Psoriasis. Eurasian J Med. 2017; 49(2): 124–127.
11. Luca M, Musumeci ML, D'Agata E, Micali G. Depression and sleep quality in psoriatic patients: impact of psoriasis severity. Int J Psychiatry Clin Pract. 2020;24(1):102-104.
12. Fleischer AB Jr, Feldman SR, Rapp SR, Reboussin DM, Exum ML, Clark AR, Rajashekhar V. Disease severity measures in a population of psoriasis patients: the symptoms of psoriasis correlate with self-administered psoriasis area severity index scores. J Invest Dermatol. 1996 Jul;107(1):26-9.
13. Stinco G, Trevisan G, Piccirillo F, Di Meo N, Nan K, Deroma L, Bergamo S, Patrone P. Psoriasis vulgaris does not ad-

versely influence the quality of sleep. G Ital Dermatol Venereol. 2013 Dec;148(6):655-9. PMID: 24442047.

14. Koo J. Population-based epidemiologic study of psoriasis with emphasis on quality of life assessment. Dermatol Clin 1996; 14: 485-96
15. Tan X, Feldman S, and Balkrishnan R. Quality of life issues and measurement in patients with psoriasis. Psoriasis: Targets and Therapy 2012:2 13–23.
16. Kirby B, Richards HL, Woo P, Hindle E, Main CJ, Griffiths CE. Physical and psychologic measures are necessary to assess overall psoriasis severity. J Am Acad Dermatol. 2001 Jul;45(1):72-6. doi: 10.1067/mjd.2001.114592. PMID: 11423838.
17. de Korte J, Sprangers MA, Mombers FM, Bos JD. Quality of life in patients with psoriasis: a systematic literature review. J Investig Dermatol Symp Proc. 2004;9(2):140-7.
18. Puzenat E, Bronsard V, Prey S. What are the best outcome measures for assessing plaque psoriasis severity?: A systematic review of the literature. J Eur Acad Dermatol Venereol. 2010;24(Suppl 2):10–16.
19. Reich A, Szepietowski JC. Mediators of pruritus in psoriasis. Mediators Inflamm 2007; 2007:1–6.
20. Zachariae R, Zachariae C, Lei U, Pedersen AF. Affective and sensory dimensions of pruritus severity: associations with psychological symptoms and quality of life in psoriasis patients. Acta Derm Venereol. 2008;88(2):121-7.
21. Reich A, Hrehorów E, Szepietowski JC. Pruritus is an important factor negatively influencing the well-being of psoriatic patients. Acta Derm Venereol. 2010;90(3):257-63.
22. Sahi FM, Masood A, Danawar NA et al. Association Between Psoriasis and Depression: A Traditional Review. Cureus. 2020; 12(8): e9708.
23. Balta I et al. General psychiatric symptoms, quality of sleep, and coping strategies in patients with psoriasis vulgaris. Int J Dermatol. 2016;55(1):60-4.
24. Rieder E, Tausk F. Psoriasis, a model of dermatologic psychosomatic disease: psychiatric implications and treatments. Int J Dermatol. 2012;51(1):12-26.
25. Kouris A, Platsidaki E, Kouskoukis C, Christodoulou C. Psychological parameters of psoriasis. Psychiatriki. 2017;28(1):54-59.
26. Dalgard FJ et al. The psychological burden of skin diseases: a cross-sectional multicenter study among dermatological out-patients in 13 European countries. J Invest Dermatol. 2015;135(4):984-991.
27. Fang H, Tu S, Sheng J, Shao A. Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. J Cell Mol Med. 2019; 23(4): 2324–2332.
28. Schmitt JM, Ford DE. Role of depression in quality of life for patients with psoriasis. Dermatology. 2007;215(1):17-27.
29. Patel N, Nadkarni A, Cardwell LA et al. Psoriasis, Depression, and Inflammatory Overlap: A Review. Am J Clin Dermatol. 2017;18(5):613-620.
30. Fortune DG, Richards HL, Griffiths CEM. Psychologic factors in psoriasis: consequences, mechanisms, and interventions. Dermatol Clin. 2005;23(4):681-94.
31. Esposito M, Saraceno R, Giunta A et al. An Italian study on psoriasis and depression. Dermatology. 2006;212(2):123-7.
32. Akay A, Pekcanlar A, Bozdag KE at al. Assessment of depression in subjects with psoriasis vulgaris and lichen planus. J Eur Acad Dermatol Venereol. 2002;16(4):347-52.
33. Griffiths CEM, Richards HL. Psychological influences in psoriasis. Clin Exp Dermatol. 2001;26(4):338-42.
34. Gupta MA, Gupta AK. Depression modulates pruritus perception. A study of pruritus in psoriasis, atopic dermatitis and chronic idiopathic urticaria. Ann N Y Acad Sci. 1999;885:394-5.
35. Spuls PI et al. How Good Are Clinical Severity and Outcome Measuresfor Psoriasis?: Quantitative Evaluation in a Systematic Review. J Invest Dermatol. 2010;130(4):933-43.
36. Puzenat E et all. What are the best outcome measures for assessing plaque psoriasis severity? A systematic review of the literature. J Eur Acad Dermatol Venereol. 2010;24 Suppl 2:10-6.
37. Reich A, Heisig M, Phan NQ et al. Visual analogue scale: evaluation of the instrument for the assessment of pruritus. Acta Derm Venereol. 2012;92(5):497-501.
38. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol. Meas. 1977;1:385–401.
39. Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI)—a simple practical measure for routine clinical use. Clin Exp Dermatol. 1994;19(3):210-6.
40. Buysse DJ, Reynolds CF, Monk TH et al. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213.
41. Weissman MM, Sholomskas D, Pottenger M, Prusoff BA, Locke BZ. Assessing depressive symptoms in five psychiatric populations: a validation study. Am J Epidemiol. 1977;106(3):203-14.
42. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav Res Methods. 2008;40(3):879-91.
43. Hayes AF. Introduction to Mediation, Moderation, and Conditional Process Analysis Second Edition A Regression-Based Approach. 2018.
44. Nowakowski S, Meers J, Heimbach E. Sleep and Women's Health. Sleep Med Res. 2013; 4(1):1–22.
45. Lindberg E, Janson C, Gislason T et al. Sleep disturbances in a young adult population: can gender differences be explained by differences in psychological status? Sleep. 1997;20(6):381-7.
46. Romero-Corral A, Caples SM, Lopez-Jimenez F et al. Interactions Between Obesity and Obstructive Sleep Apnea. Chest. 2010; 137(3): 711–719.

47. Papadavid E, Vlami K, Dalamaga M et al. Sleep apnea as a comorbidity in obese psoriasis patients: a cross-sectional study. Do psoriasis characteristics and metabolic parameters play a role? J Eur Acad Dermatol Venereol. 2013;27(7):820-6.
48. Hirotsu C, Nogueira H, Albuquerque RG. The bidirectional interactions between psoriasis and obstructive sleep apnea. Int J Dermatol. 2015;54(12):1352-8.
49. Diaz-Morales JF, Escribano C, Jankowski KS, Vollmer C, Randler C. Evening adolescents: The role of family relationships and pubertal development. Journal of Adolescence 2014; 37:425–432.
50. Di Milia L, Adan A, Natale V, Randler C. Reviewing the psychometric properties of contemporary circadian typology measures . Chronobiology International 2013; 30(10): 1261-1271.