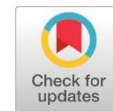


Research Article

<sup>6</sup>Open Access



## Quality of Life and Inferred Psychosocial Burden in Libyan Patients with Psoriasis: A Cross-Sectional Study

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### Abstract

**Background and Objective:** Psoriasis is a chronic condition that profoundly impacts patients' quality of life and psychosocial well-being. This study aimed to evaluate the quality of life and inferred psychosocial burden among Libyan patients with psoriasis and to explore their association with disease severity. **Methods:** A cross-sectional study was conducted among 114 Libyan patients with psoriasis. Data on sociodemographic characteristics, disease severity, and treatment modalities were collected. The Dermatology Life Quality Index (DLQI) was utilized to assess the quality of life, and psychosocial burden was inferred from the psychosocial domains of the DLQI. Data were analyzed using SPSS version 20.0. **Results:** The mean age of the participants was  $40.18 \pm 16.19$  years, with females comprising 55.3%. Mild psoriasis was observed in 77.2% of patients, while moderate and severe cases accounted for 13.2% and 9.6%, respectively. The median overall DLQI score was 11.50, with 50.0% of patients experiencing a "very large effect" on their lives. A significant association was found between psoriasis severity and DLQI scores (Kruskal-Wallis  $H = 38.248$ ,  $p < 0.001$ ). **Conclusion:** Psoriasis profoundly impairs the quality of life of Libyan patients, strongly correlating with disease severity. However, the associated psychosocial burden is solely inferred from DLQI domains; therefore, incorporating independent, validated psychiatric assessment instruments is highly recommended for future studies to accurately evaluate psychological comorbidities.

**Keywords:** Psoriasis; DLQI; Quality of Life; Libya; Psychosocial burden; psoriasis severity.

## INTRODUCTION

Psoriasis represents a complex, systemic inflammatory disorder driven by immune-mediated pathways, which, despite its predominant cutaneous presentations, affects multiple systemic axes. This dermatological pathology routinely inflicts profound social, physical, and psychological distress upon afflicted individuals, generating a clinical and personal burden that frequently rivals or surpasses that documented in other debilitating chronic medical conditions (Ghezzi et al., 2024).

Due to its visible nature, chronic course, and frequently distressing cutaneous symptoms, psoriasis profoundly impairs the health-related quality of life (HRQoL) of affected individuals (Arnāte et al., 2026). The holistic impact of the disease has increasingly led researchers to view psoriasis not just



as a dermatological issue, but as a condition intricately linked with psychological well-being and systemic health.

The psychosocial burden of psoriasis is well documented in the contemporary literature. Studies have repeatedly shown that patients with psoriasis experience disproportionately high levels of psychological distress, including profound embarrassment, social withdrawal, and relationship strains (Luna et al., 2023). Psychological distress, particularly feeling of sadness and anxiety related concerns, are frequent comorbidities that can both result from and exacerbate the chronicity of the disease (Siteneski et al., 2025; Uğurer, Altunay, Özkur, & Baltan, 2023). In many instances, the prevalence of these psychological comorbidities correlates strongly with the severity of the disease and significantly impedes the successful management of the condition (Bakar, Jaapar, Azmi, & Aun, 2021; Pollo et al., 2021). Furthermore, the condition frequently disrupts intimate relationships and sexual functioning; creating a cycle of distress that diminishes overall life satisfaction (Agaoglu, Yilmaz-Karaman, Acikbas, & Kaya Erdogan, 2025; Kulacaoglu, Yildirim, Ilyas, Ugurlu, & Solak, 2025). Additional hidden burdens, such as disease-activity-related sleep dysfunctions, further compound the psychological toll of the disease, hindering the patient's daily functionality and mood (Currado et al., 2026; Hazarika et al., 2026).

Evaluating this complex burden requires robust, patient-reported outcome measures. The Dermatology Life Quality Index (DLQI) has emerged as an indispensable instrument in clinical practice and research for quantifying the impact of dermatological conditions on patients' daily lives (Mouseli et al., 2026). While it is primarily a quality-of-life tool, its specific domains—which query feelings of embarrassment, interference with social and athletic activities, difficulties at work or study, and sexual or interpersonal problems—provide critical insights into the psychosocial and emotional disturbances experienced by patients (Walniczek et al., 2025). Interventions ranging from systemic and biologic therapies to cognitive behavioral approaches like mindfulness have been shown to not only clear the skin but also significantly alleviate these DLQI-measured psychosocial burdens (Žaliukaitė & Raudonis, 2026; Cuniberti et al., 2026; Zhao et al., 2026).

Various demographic, clinical, and environmental factors have been identified as predictors of quality of life in psoriasis patients across different geographic populations, from African registries to large Asian cross-sectional cohorts (Chen et al., 2026; Wang et al., 2026; Lee et al., 2018). External environmental stressors have also been shown to interact with the disease, further affecting mental health and quality of life (Shao et al., 2025). However, data regarding the specific burden of psoriasis on quality of life and psychosocial well-being among patients in Libya remain scarce. Given the unique sociocultural context and potential variations in healthcare access, understanding the local impact of the disease is imperative. Therefore, this cross-sectional study was designed to evaluate the quality of life and inferred psychosocial burden among Libyan patients with psoriasis, and to investigate the association between disease severity and the magnitude of quality-of-life impairment.

## **MATERIALS AND METHODS**

### **Study Design and Participants**

A cross-sectional observational study was carried out on 114 consenting Libyan patients with established diagnoses of psoriasis who attended the dermatology outpatient clinics in Al-Bayda city, Libya. A convenience sampling method was utilized to capture a comprehensive dataset encompassing demographic characteristics, clinical features, treatment modalities, disease severity, and patient-reported quality-of-life outcomes. Given that data collection was restricted to outpatient settings within a single geographic location, the sample predominantly reflects individuals with milder or managed forms of the disease, thereby accounting for the statistical distribution observed

in this cohort.

### Eligibility Criteria

- **Inclusion Criteria:** Patients aged 17 years or older with a definitive clinical diagnosis of psoriasis were included. For participants younger than 18 years, written parental/legal guardian consent and participant assent were obtained.
- **Exclusion Criteria:** Individuals were excluded if they were currently receiving psychotropic therapies; presented with major systemic comorbidities or severe chronic illnesses; or exhibited cognitive, linguistic, auditory, or visual deficits that could hinder independent questionnaire completion.

### Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The study protocol was formally reviewed and approved by the Research Ethics Committee of [Faculty of Medicine, Omar Al-Mukhtar University] approval number (NBC: 007. H 25. 66). Prior to participation, written informed consent was obtained from all individual patients included in the study. All participant data were kept strictly confidential and anonymized to ensure privacy."

### Variables and Measures

The sociodemographic variables recorded included age and sex. Clinical variables included disease duration (in years), treatment type (topical, systemic, phototherapy, or a combination of topical and systemic), and the severity of psoriasis. The clinical severity of psoriasis was assessed using the Psoriasis Area and Severity Index (PASI) by a qualified dermatologist on the same day of the DLQI questionnaire completion. The standard PASI scoring model was consistently applied to all patients, focusing primarily on plaque-type psoriasis (psoriasis vulgaris) to ensure clinical homogeneity. Patients were categorized as mild (PASI < 5), moderate (PASI 5–10), and severe (PASI > 10).

To quantify the precise ramifications of the disease on patients' health-related quality of life, the Dermatology Life Quality Index (DLQI) was deployed. This psychometric instrument evaluates multiple distinct dimensions, including physical symptoms, emotional states, routine daily operations, recreational capacities, professional or academic performance, interpersonal dynamics, and treatment-related adverse effects. The instrument utilizes a standard 4-point Likert scale for each item, ranging from 0 (indicating no impact) to 3 (indicating maximum impairment), resulting in a cumulative score range of 0 to 30.

The validated Arabic version of the DLQI was utilized in this study. For literate participants, the questionnaire was self-administered. For patients with limited literacy or reading difficulties, the questionnaire items were read aloud by the researchers in a neutral, non-leading manner to assist in completion while maintaining objectivity.

In this study, psychological distress were inferred directly from the specific psychosocial domains of the DLQI (such as embarrassment, social restriction, work/study interference, relationship strain, and sexual difficulties) rather than diagnosed using a standalone psychiatric diagnostic tool (e.g., PHQ-9 or HADS).

### Statistical Analysis

Statistical analysis was performed utilizing SPSS version 20.0. Continuous variables were assessed for normality. Normally distributed variables were summarized as mean  $\pm$  standard deviation (SD), while non-normally distributed data were expressed as median and interquartile range (IQR). Categorical variables were presented as frequencies and percentages. The Chi-square test or Monte Carlo exact test was applied to compare categorical parameters across severity groups. Discrepancies in

cumulative DLQI scores across clinical subgroups were evaluated using the non-parametric Kruskal-Wallis test. A p-value of less than 0.05 was considered statistically significant for all tests.

## RESULTS

### Sociodemographic and Clinical Characteristics

The baseline assessment of the study population comprised 114 Libyan patients with a confirmed clinical diagnosis of psoriasis. The cohort demonstrated a slight female predominance, with 63 females (55.3%) and 51 males (44.7%) participating in the study. The age distribution of the sample spanned from 17 to 90 years, exhibiting a mean age of  $40.18 \pm 16.19$  years and a median of 40.0 years (IQR: 24.0–53.0).

In terms of clinical presentation, the vast majority of the patients (77.2%) manifested mild psoriasis based on their Psoriasis Area and Severity Index (PASI) scores. Moderate and severe forms of the condition were documented in 13.2% and 9.6% of the clinical sample, respectively. The chronicity of the disease was evidenced by an overall mean disease duration of  $14.63 \pm 8.97$  years. Regarding therapeutic interventions, nearly half of the participants (48.2%) were managing their condition utilizing topical treatments exclusively. The comprehensive baseline sociodemographic and clinical parameters of the study population are summarized in Table 1.

**Table: (1).** Sociodemographic and clinical characteristics of the study population (n = 114)

| Variables                     | Statistics: No. (%) / Mean $\pm$ SD / Median (IQR) |
|-------------------------------|----------------------------------------------------|
| Sex                           |                                                    |
| Male                          | 51 (44.7%)                                         |
| Female                        | 63 (55.3%)                                         |
| Age (years)                   |                                                    |
| Minimum – Maximum             | 17.0 – 90.0                                        |
| Mean $\pm$ SD                 | $40.18 \pm 16.19$                                  |
| Median (IQR)                  | 40.0 (24.0 – 53.0)                                 |
| Severity of Psoriasis         |                                                    |
| Mild (PASI < 5)               | 88 (77.2%)                                         |
| Moderate (PASI 5 – 10)        | 15 (13.2%)                                         |
| Severe (PASI > 10)            | 11 (9.6%)                                          |
| Type of Treatment             |                                                    |
| Topical Therapy               | 55 (48.2%)                                         |
| Systemic Therapy              | 33 (28.9%)                                         |
| Phototherapy                  | 9 (7.9%)                                           |
| Combined (Topical & Systemic) | 17 (14.9%)                                         |
| Disease Duration (years)      |                                                    |
| Minimum – Maximum             | 2.0 – 40.0                                         |
| Mean $\pm$ SD                 | $14.63 \pm 8.97$                                   |
| Median (IQR)                  | 14.50 (7.0 – 20.0)                                 |

### DLQI Item Responses and Inferred Psychosocial Burden

The item-specific analysis of the Dermatology Life Quality Index (DLQI) demonstrated extensive functional, emotional, and psychosocial impairments among the surveyed individuals. Emotional distress was particularly pronounced, with 40.4% of the patients reporting feeling embarrassed or self-conscious "a lot" due to their skin, and an additional 12.3% experiencing this "very much". Furthermore, the pathology substantially hindered daily occupational and educational functionalities; the disease restricted 42.1% of the patients from working or studying either "a lot" (29.8%) or "very much" (12.3%).

Interpersonal dynamics and intimacy were also markedly compromised within this cohort. Approximately 21.1% of the patients encountered significant problems ("a lot") with partners or friends, while 37.7% reported mild interpersonal friction ("a little"). Furthermore, sexual dysfunction and related intimacy difficulties impacted 44.7% of the total cohort to varying degrees of severity. These continuous domain impairments indicate a heavy inferred psychological and social burden secondary to the primary dermatological condition. The item-by-item distribution of the DLQI responses is structured systematically in Table 2.

**Table: (2).** Dermatology Life Quality Index (DLQI) item-specific responses (n = 114)

| DLQI Item / Domain                                  | Not at AllNo.<br>(%) | A LittleNo.<br>(%) | A LotNo.<br>(%) | Very MuchNo.<br>(%) |
|-----------------------------------------------------|----------------------|--------------------|-----------------|---------------------|
| Degree of Physical Pain or Itching                  | 27 (23.7%)           | 37 (32.5%)         | 29 (25.4%)      | 21 (18.4%)          |
| Degree of Embarrassment or Self-consciousness       | 28 (24.6%)           | 26 (22.8%)         | 46 (40.4%)      | 14 (12.3%)          |
| Interference with Daily Shopping or Home Activities | 33 (28.9%)           | 35 (30.7%)         | 24 (21.1%)      | 22 (19.3%)          |
| Influence on the Choice of Everyday Clothing        | 22 (19.3%)           | 33 (28.9%)         | 31 (27.2%)      | 28 (24.6%)          |
| Impairment of Social or Leisure Activities          | 29 (25.4%)           | 30 (26.3%)         | 31 (27.2%)      | 24 (21.1%)          |
| Creation of Difficulties in Athletic Activities     | 46 (40.4%)           | 32 (28.1%)         | 28 (24.6%)      | 8 (7.0%)            |
| Prevention or Hindrance in Working or Studying      | 48 (42.1%)           | 18 (15.8%)         | 34 (29.8%)      | 14 (12.3%)          |
| Creation of Problems with Partners or Close Friends | 43 (37.7%)           | 43 (37.7%)         | 24 (21.1%)      | 4 (3.5%)            |
| Induction of Sexual or Intimacy Difficulties        | 63 (55.3%)           | 35 (30.7%)         | 10 (8.8%)       | 6 (5.3%)            |
| Extent of Problems Induced by Psoriasis Treatment   | 39 (34.2%)           | 43 (37.7%)         | 18 (15.8%)      | 14 (12.3%)          |

### Overall Quality of Life Impairment

The overall health-related quality of life was substantially lower in the study group, as indicated by a mean cumulative DLQI score of  $11.82 \pm 6.53$  and a median score of 11.50 (IQR: 6.0–18.0). Categorical grading of the cumulative outcomes demonstrated that exactly half of the patient cohort (50.0%) suffered a "very large effect" of the disease on their daily life, with an additional 4.4% reporting an "extremely large effect". Conversely, a negligible minority of only 4.4% of the participants reported that psoriasis exerted no measurable effect on their daily life operations. The categorical stratifications of the cumulative life impairment scores are presented in Table 3.

**Table: (3).** Overall cumulative DLQI scores and clinical severity categories (n = 114)

| DLQI Impact Level / Total Score Parameters                           | Patient Frequency: No. (%) / Descriptive Values |
|----------------------------------------------------------------------|-------------------------------------------------|
| DLQI Functional Impact Level                                         |                                                 |
| No effect on patient's quality of life (Score: 0 - 1)                | 5 (4.4%)                                        |
| Small effect on patient's quality of life (Score: 2 - 5)             | 21 (18.4%)                                      |
| Moderate effect on patient's quality of life (Score: 6 - 10)         | 26 (22.8%)                                      |
| Very large effect on patient's quality of life (Score: 11-20)        | 57 (50.0%)                                      |
| Extremely large effect on patient's quality of life (Score: 21 - 30) | 5 (4.4%)                                        |
| Cumulative Score Distribution                                        |                                                 |
| Minimum – Maximum Range                                              | 1.0 – 28.0                                      |
| Mean $\pm$ Standard Deviation (SD)                                   | $11.82 \pm 6.53$                                |
| Median Score (Interquartile Range)                                   | 11.50 (6.0 – 18.0)                              |

### Association between Psoriasis Severity and DLQI

Inferential statistical evaluation identified a highly significant correlation between the clinical severity of psoriasis (PASI bands) and the corresponding level of health-related quality of life impairment (Chi-square = 28.551,  $p < 0.001$ ). Among individuals presenting with moderate disease

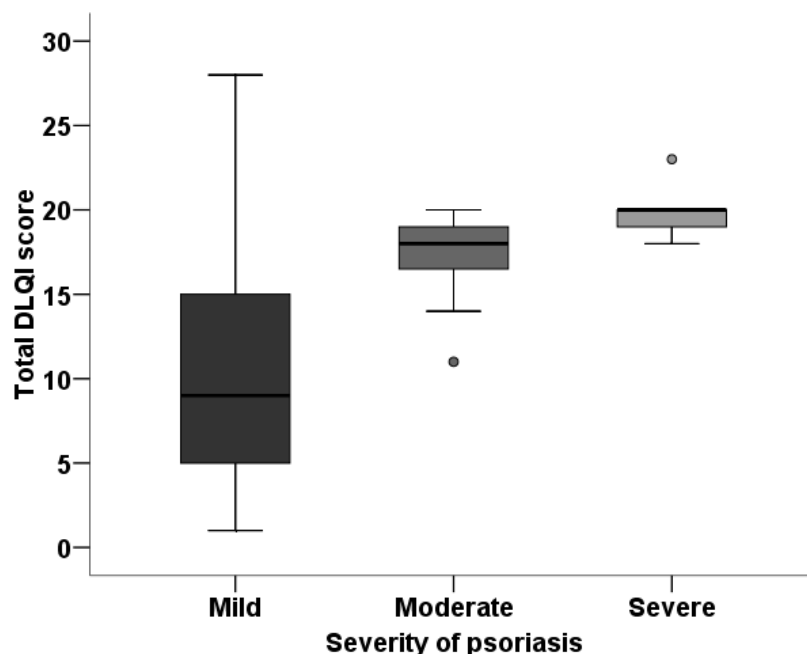
forms, 100% experienced a "very large effect" on their life satisfaction. Similarly, within the severe group, 90.9% faced a "very large effect" and 9.1% reported an "extremely large effect" on their psychosocial functionality.

The continuous cumulative DLQI scores elevated markedly in tandem with advancing clinical severity, progressing from a mean of  $9.86 \pm 6.09$  in the mild presentation group to  $17.47 \pm 2.45$  in the moderate subpopulation, and peaking at  $19.73 \pm 1.27$  within the severe disease category. Non-parametric testing confirmed that these discrepancies across the clinical subgroups were highly statistically significant (Kruskal-Wallis  $H = 38.248$ ,  $p < 0.001$ ). The detailed associative cross-tabulations between disease severity indices and quality of life responses are presented in Table 4.

**Table: (4).** Cross-tabulation and statistical associations between psoriasis severity and DLQI scores (n = 114)

| DLQI Impact Parameters      | Mild (PASI < 5)<br>(n = 88) | Moderate (PASI 5 – 10)<br>(n = 15) | Severe (PASI > 10)<br>(n = 11) | Statistical Test            | Significance (p-value) |
|-----------------------------|-----------------------------|------------------------------------|--------------------------------|-----------------------------|------------------------|
| Impact Level, No. (%)       |                             |                                    |                                |                             |                        |
| No effect (0 - 1)           | 5 (5.7%)                    | 0 (0.0%)                           | 0 (0.0%)                       | Chi-square test=<br>28.551  | < 0.001* (MC)          |
| Small effect (2 - 5)        | 21 (23.9%)                  | 0 (0.0%)                           | 0 (0.0%)                       |                             |                        |
| Moderate effect (6 - 10)    | 26 (29.5%)                  | 0 (0.0%)                           | 0 (0.0%)                       |                             |                        |
| Very large effect (11 - 20) | 32 (36.4%)                  | 15 (100.0%)                        | 10 (90.9%)                     |                             |                        |
| Extremely large (21 - 30)   | 4 (4.5%)                    | 0 (0.0%)                           | 1 (9.1%)                       |                             |                        |
| Total Score Parameters      |                             |                                    |                                |                             |                        |
| Minimum – Maximum           | 1.0 – 28.0                  | 11.0 – 20.0                        | 18.0 – 23.0                    | Kruskal-Wallis<br>H= 38.248 | < 0.001* (KW)          |
| Mean $\pm$ SD               | $9.86 \pm 6.09$             | $17.47 \pm 2.45$                   | $19.73 \pm 1.27$               |                             |                        |
| Median (IQR)                | 9.0 (5.0 – 15.0)            | 18.0 (16.5 – 19.0)                 | 20.0 (19.0 – 20.0)             |                             |                        |

Chi-square: Chi-square test; MC: Monte Carlo Exact p-value; H: Kruskal-Wallis test. Statistically significant at p-value 0.05.



**Figure (1).** Association between psoriasis severity and total DLQI score.

## DISCUSSION

This cross-sectional study offers critical insights into the profound quality-of-life impairment and psychological burden borne by Libyan patients suffering from psoriasis. In our cohort, the mean age and relatively even sex distribution align with typical epidemiological profiles of psoriasis observed globally (Wang et al., 2026; Lee et al., 2018). The striking finding of this study is the magnitude of the disease's impact: an overwhelming 54.4% of patients reported that psoriasis had a "very large" or "extremely large" effect on their lives. These findings corroborate the extensive literature asserting that psoriasis goes far beyond a cosmetic nuisance, acting instead as a severely debilitating condition that disrupts the core elements of a patient's life (Luna et al., 2023; Ghezzi, Costanzo, & Borroni, 2024).

A key element of our investigation was inferring psychological burden through the psychosocial components of the DLQI. It is important to acknowledge that clinical depression and anxiety were not assessed using a standalone psychiatric diagnostic tool in this sample. Rather, the psychological distress is vividly reflected in the patients' responses to specific DLQI domains. For example, over half of the cohort Experienced embarrassment or self-consciousness "a lot" or "very much," and nearly half reported significant interference with work or study. This limitation on social life and work involvement is a recognized warning sign that can lead to more burden on mental health issues, which may participate in subclinical depressive and anxious symptomatology

, as highlighted in numerous international studies (Bakar, Jaapar, Azmi, & Aun, 2021; Siteneski et al., 2025). The intense feelings of stigmatization reported by our patients mirror the psychosocial burden discussed in groups with comparable long-lasting skin conditions such as atopic dermatitis (Arnāte et al., 2026).

Additionally, the impact of psoriasis on personal areas of life was prominent, with a substantial proportion of patients reporting difficulties with their partners, friends, and sexual activities. These domains are known to be particularly sensitive indicators of psychological well-being. When an individual's ability to connect socially and intimately with others is compromised, it greatly reduces life satisfaction and strongly contributes to heightened feelings of anxiety (Kulacaoglu et al., 2025). Such interpersonal strains can sometimes escalate, pointing to broader psychosocial vulnerabilities, as suggested by contemporary literature linking chronic skin disease burden to intimate partner distress (Agaoglu et al., 2025). The cumulative effect of physical symptoms—such as feeling of social isolation, which affected a majority of our sample to some degree—and these psychosocial barriers inevitably compromises overall mental health (Walniczek et al., 2025).

Our analysis demonstrated a powerful, statistically significant correlation between the clinical severity of psoriasis (measured via PASI categories) and the degree of DLQI impairment (Kruskal-Wallis  $H = 38.248$ ,  $p\text{-value} < 0.001$ ). Patients with moderate and severe disease universally experienced at least a "very large effect" on their Quality-of-Life. This dose-response relationship between disease severity and quality-of-life deterioration has been consistently documented across diverse demographic registries, highlighting the universal nature of the disease's burden regardless of geographic or cultural context (Chen et al., 2026; Mouseli et al., 2026). The high burden observed even in the mild group (where nearly half experienced a moderate to very large effect) underscores that clinical severity metrics alone do not fully capture the patient's subjective distress. This discrepancy is a recognized phenomenon, where factors such as sleep dysfunction (Hazarika et al., 2026; Currado et al., 2026) and external psychological stressors (Shao et al., 2025) interact to amplify the perceived severity of the disease.

The findings advocate for a paradigm shift in the holistic management of psoriasis. Given that

nearly 30% of our patients reported problems caused by the treatment itself, selecting therapeutic modalities must account for the patient's individual experience and treatment burden. Although the present study was not designed to compare treatment modalities, future prospective studies in Libya may examine whether advanced systemic or biologic therapies improve both clinical outcomes and DLQI scores. Modern biologic regimens have been highlighted in the literature as highly effective options that can achieve superior clinical outcomes compared to traditional therapies, potentially restoring both physical clearance and psychological well-being (Cuniberti et al., 2026; Ugurer et al., 2023; Žaliukaitė & Raudonis, 2026). Therefore, prospective local studies are highly recommended to evaluate the feasibility, cost-effectiveness, and quality-of-life outcomes of integrating these modern therapies within the Libyan healthcare context. Furthermore, the high degree of inferred psychological distress in our cohort suggests that dermatological interventions should ideally be supplemented with structured psychological support. Evidence-based approaches, such as online mindfulness-based cognitive therapy, have proven to be efficacious adjuvant interventions that can significantly lessen the emotional and psychiatric impact of chronic psoriasis (Pollo et al., 2021; Zhao et al., 2026).

Several methodological constraints in the current study warrant consideration. Primarily, the cross-sectional design restricts our capacity to establish definitive causal pathways between psoriasis severity and quality-of-life impairments. Additionally, psychological distress was inferred through the multidimensional subscales of the DLQI rather than being established via structured, standalone psychiatric screening instruments (such as HADS or PHQ-9). Furthermore, the cohort (n = 114) was recruited exclusively from outpatient clinics in Al-Bayda using convenience sampling, which potentially limits the generalizability of these insights to severe inpatient cases or broader Libyan populations. Lastly, potential confounding variables such as socioeconomic status, education level, exact anatomical site of involvement, visibility of lesions, comorbidities, and treatment adherence were not controlled for, which may have influenced the reported DLQI scores.

## CONCLUSION

In conclusion, psoriasis was associated with substantial impairment in quality of life among Libyan patients, particularly in domains related to embarrassment, social activities, work/study, and interpersonal relationships. DLQI scores increased significantly with clinical disease severity. Because psychological burden was inferred from DLQI domains rather than measured using standalone psychiatric instruments, future studies should include validated tools for depression, anxiety, and perceived stress.

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## ETHICS

**Ethical Considerations:** This study was conducted in strict accordance with the ethical principles of the Declaration of Helsinki. The study protocol was formally reviewed and approved by the Research Ethics Committee of the Faculty of Medicine, Omar Al-Mukhtar University (NBC: 007. H 25. 66). Prior to enrollment, written informed consent was obtained from all individual participants included in the study. All participant data were completely anonymized and maintained with strict

confidentiality to ensure privacy.

For participants aged 17 years, written informed consent was obtained from their parents or legal guardians, along with written assent from the participants themselves, in accordance with institutional ethical guidelines.

**Conflict of Interest:** The authors declare that they have no conflict of interest associated with this manuscript.

**Author contributions:** S.A.H.A. conceived and designed the study, collected the data, provided data/analysis tools, performed the statistical analysis and data interpretation, and approved the final version of the manuscript to be published. H.M.Y.G. contributed data/analysis tools, participated in the analysis and interpretation of data, took part in drafting and revising the manuscript, and approved the final version of the manuscript. M.A.M., S.A.S., and M.Y.S. contributed to data collection, provided data/analysis tools, and were responsible for drafting and critically revising the manuscript for important intellectual content. All authors have read and approved the final version of the manuscript to be published and agree to be accountable for all aspects of the work.

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