Review Article

Quality of Life and Management of Atopic Dermatitis among Pediatric Saudi Population: A Systematic Review

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Abstract

The prevalence of atopic dermatitis (AD), a chronic skin condition, is rising globally. Worldwide, there are AD management guidelines accessible, but Saudi Arabia lacks pediatric AD-specific guidelines. This systematic review investigates the QoL and management of AD among the Saudi pediatric population. PubMed, Web of Science, Science Direct, Google Scholar, and EBSCO were systematically searched to include the relevant literature. Rayyan QRCI was used throughout this systematic approach. A total of nine studies with 2928 patients were included in this review, and 60.6% of them were males were included in this review. In this systematic review, we found that most AD patients experienced a decrease in their QoL. Bacterial colonization was relatively common among AD patients. Shared decision-making amongst the parents/caregivers, various specialties, and professionals should be the foundation of pediatric AD treatment. Emollient therapy should be advised after a careful evaluation of the severity. To create a national standard encompassing all stakeholders' thoughts and proposals, multidisciplinary collaboration is required.

Keywords: Quality of life, Management, Atopic dermatitis, Children, Saudi Arabia, Systematic review

Introduction

Up to 20% of children and 5-10% of adults may have chronic, relapsing-remitting skin conditions known as atopic dermatitis (AD) [1, 2]. The condition frequently affects individuals with atopy, such as allergic rhinitis or asthma, and manifests as severe itching and recurrent eczematous lesions. It causes significant morbidity and worsens quality of life (QoL) [3, 4]. The pathophysiology of AD is intricate and multifaceted, with a genetic, epidermal barrier, immunological, microbial colonization, lifestyle, and environmental variables all contributing to the disease [5].

A prevalent skin condition in children, pediatric AD typically manifests in the first six months of life [6]. By the age of one year, about 60% of pediatric children display AD symptoms [7, 8], and by the age of five, nearly 85%. Although AD in children may progress or go into remission, the condition frequently lasts into adulthood [9]. Patients who have evident remission continue to have aberrant skin and are more likely to experience clinical symptoms [10]. According to cohort research, the early beginning of the disease, allergic rhinitis in childhood, and hand eczema were all associated with 50% of children with AD persisting into adulthood [11].

In daily clinical practice, the management of AD takes into account a variety of criteria and can vary between healthcare professionals. The availability of regional treatments and the variety of the disease have led to considerable differences in international guidelines for the management of AD. To help dermatologists and other healthcare professionals in Saudi Arabia ensure the safe and effective management of AD for their patients, the current consensus recommendations were developed with this in mind and light of recent advancements in therapeutic development and evidence-based recommendations [12].

The aim of managing AD is to improve symptoms and indicators over the long and short term, control aberrant immunological responses, and restore skin barrier function [13]. In mild-to-moderately ill patients, topical corticosteroids and other topical medications are recommended as first-line treatments [14]. Additional standard systemic therapies, including cyclosporin, methotrexate, azathioprine, and mycophenolate mofetil, can

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be administered when topical medicines are ineffective [15]. For the treatment of moderate-to-severe AD in adults and adolescents 12 years of age and older, as well as for the treatment of severe atopic dermatitis in children 6 to 11 years of age who are eligible for systemic therapy, targeted therapy using a dupilumab monoclonal antibody is indicated [16]. This systematic review investigates the QoL and management of AD among the Saudi pediatric population.

Materials and Methods

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were followed for this systematic review [17].

Study Design and Duration

This was a systematic review conducted between June and July 2023.

Search Strategy

To retrieve the relevant research, a thorough search was conducted across five major databases, including Google Scholar, PubMed, Web of Science, Science Direct, and EBSCO. We only searched in English and took into account each database's unique criteria. The following keywords were converted into PubMed Mesh terms and used to find studies that were related; "Quality of life," "Management," "Treatment," "Atopic dermatitis," "Children," "Pediatric," "School children," "Teenagers," "Saudi Arabia," and "KSA." The Boolean operators "OR" and "AND" matched the required keywords. Among the search results were publications in full English language, freely available articles, and human trials.

Selection Criteria

We considered the following criteria for inclusion in this review:

- Any study designs that investigated the QoL and management of AD among the Saudi pediatric population.
- Only pediatric patients (< 18 years).
- English language.
- Free accessible articles.

Data Extraction

Duplicates in the search strategy output were found using Rayyan (QCRI) [18]. To determine the relevance of the titles and abstracts, the researchers used a set of inclusion/exclusion criteria to filter the combined search results. Each paper that matched the requirements for inclusion was carefully read by the reviewers. The authors provided other methods of resolving disputes with some thought. With the use of a previously created data extraction form, the authorized study was uploaded. The authors extracted data about the study titles, authors, study year, city, participants, gender, QoL outcomes, and management.

Strategy for Data Synthesis

Summary tables were created using information from pertinent research to give a qualitative overview of the results and study components given. Following data extraction for the systematic review, the most effective strategy for utilizing data from the included study articles was selected.

Risk of Bias Assessment

Using the ROBINS-I risk of bias assessment approach for non-randomized trials of therapies, the included studies' quality was assessed [19]. The seven themes that were assessed were confounding, participant selection for the study, classification of interventions, deviations from intended interventions, missing data, assessment of outcomes, and choosing of the reported result.

Results and Discussion

Search Results

A total of 534 study articles resulted from the systematic search, and 54 duplicates were deleted. Title and abstract screening were conducted on 480 studies, and 434 studies were excluded. 46 reports were sought for retrieval, and only 1 article was not retrieved. Finally, 45 studies were screened for full-text assessment; 20 were excluded for wrong study outcomes, and 16 for the wrong population type. Nine eligible study articles were included in this systematic review. A summary of the study selection process is presented in **Figure 1**.

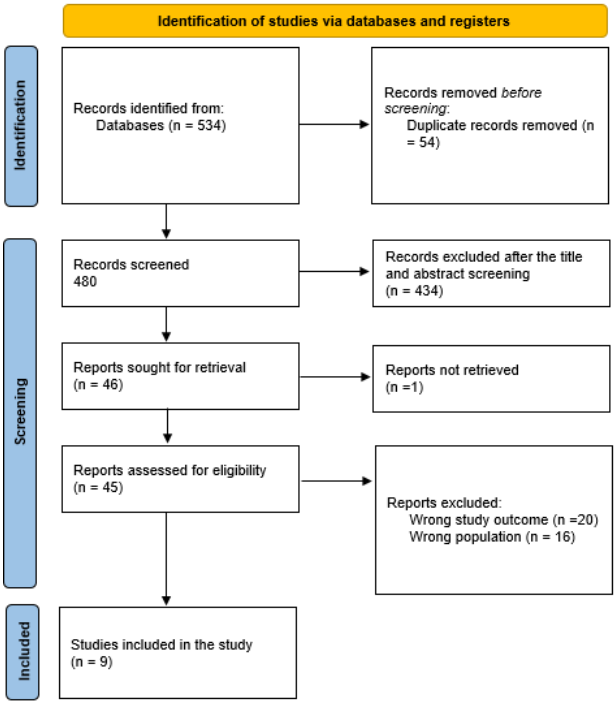

Figure 1. PRISMA flowchart summarizes the study selection process.

Characteristics of the Included Studies

Table 1 includes the sociodemographic characteristics of the included study articles. Our results included nine studies with a total of 2928 patients, and 1775 (60.6%) were males. Four studies were conducted in Qassim [20-23], two in Riyadh [19, 24], one in Aseer [25], one in Arar [26], and one in Jeddah [27]. Seven were cross-sectional studies [19-24, 27], and two were case-control studies [25, 26].

Table 2 presents the clinical characteristics of the included studies. All of the included studies demonstrated that children with AD experienced a decrease in their QoL. One study reported ocular abnormalities, which primarily included lid and corneal abnormalities [22]. Other studies reported bacterial infections, streptococcal, and gram-negative bacterial colonization complicated atopic dermatitis in children [23, 25, 26]. Regarding the sleep quality of children with AD, a study found that age, gender, sleeping index, exposure to allergens (especially perfumes, dust, dander, and pets), and associated atopic conditions (particularly allergic conjunctivitis, rhinitis, and bronchial asthma) all have an impact on sleep quality [27]. The included studies reported using daily skin regimens in addition to systematic treatment; corticosteroids, and antihistamines [19, 22].

Table 1. Sociodemographic characteristics of the included study articles.

Study	City	Study design	Participants	Mean age (years)	Males (%)
Aldosari *et al*., 2023 [19]	Riyadh	Cross-sectional	476	5-16	321 (67.4)
Alzolibani, 2014 [20]	Qassim	Cross-sectional	630	2.4 ±1.2	346 (54.9)
Al Robaee & Shahzad, 2010 [21]	Qassim	Cross-sectional	774	10.5±3.6 (months)	439 (56.7%)
Raffa *et al*., 2023 [22]	Qassim	Cross-sectional	50	10.5±3.6	27 (54)
Bilal *et al*., 2013 [23]	Qassim	Cross-sectional	80	1.4 ± 0.74	60 (75)
Alkahtani *et al*., 2022 [25]	Aseer	Case-control	78	2-12	34 (43.6%)
Alenizi, 2014 [26]	Arar	Case-control	60	4.4 ± 4.9	24 (40)
Mahmoud *et al*., 2020 [27]	Jeddah	Cross-sectional	150	40.1 ± 13.8 (months)	74 (49.3)
Abdullateef, 2014 [24]	Riyadh	Cross-sectional	630	NM	450 (71.4)

Table 2. Clinical characteristics of the included studies.

Study	QoL	Management	ROBIN-I
Aldosari *et al*., 2023 [19]	Nearly 94% of the children with AD experienced a reduction in QoL, with the effect being large or extremely large in about 28.7% of those children. There were no significant gender, age, or disease duration differences. Additionally, the two most impacted domains were discovered to be symptoms and emotions.	The majority of respondents (50%) were at ease with their daily skin care regimen and did not think it interfered with their normal daily activities.	Moderate
Alzolibani, 2014 [20]	AD negatively impacted the QoL of Saudi newborns, children, and their families. Regardless of the patient's gender or whether they have had previous atopic diseases, this impairment is closely correlated with the severity of the disease.	NM	Moderate
Al Robaee & Shahzad, 2010 [21]	The QoL for the child's parents is directly impacted by how severe their child's AD is. The results will help to gain a better understanding of the practical challenges experienced by parents of children with AD and will help develop a more effective treatment plan for atopic children.	The Dermatitis Family Impact (DFI) questionnaire helps determine how best to treat children with AD. It can be utilized as an additional parameter in clinical trials examining this topic.	Moderate
Raffa *et al*., 2023 [22]	Ocular abnormalities, which primarily included lid and corneal abnormalities, were seen in the majority of the study's young participants. Even though nearly half of the patients had severe AD based on the SCORAD severity score, none of them experienced comorbidities that could have resulted in blindness, such as glaucoma and retinal detachment. Additionally, there was no correlation between ocular abnormalities and the degree of peri-orbital, face, or facial eczema.	Regarding systemic therapy, 25% of the patients (or 50%) received only antihistamines, while two (4%) received oral steroids and antihistamines.	High
Bilal *et al*., 2013 [23]	Streptococcal and Gram-negative bacterial colonization complicated atopic dermatitis in children, and the latter was associated with the severity of the lesions. There were several Enterococci and Corynebacterium species. S. aureus continued to be the dominant organism. Determining a connection between the skin microbiome and atopic dermatitis was impossible.	NM	High

Alkahtani *et al*., 2022 [25]	The main pathogenic factor influencing the development and course of AD in children is S. aureus. Although there was no gender difference in the incidence of AD, children between the ages of 2 and 12 are more susceptible to infection. In terms of quantity, the colonization showed no difference between AD patients and healthy control AD. Rather than other bacterial colonization, staphylococcal colonization was associated with the severity of AD.	NM	Moderate
Alenizi, 2014 [26]	In the skin lesions of 65% of Saudi children with atopic dermatitis, S. aureus is present. Both the severity of the illness and the patient's age have an impact on the rate of colonization. Penicillin and erythromycin resistance are common among isolated isolates, however, floxacillin, vancomycin, and fusidic acid sensitivity still exist.	NM	Moderate
Mahmoud *et al*., 2020 [27]	Age, gender, sleeping index, exposure to allergens (especially perfumes, dust, dander, and pets), and associated atopic conditions (particularly allergic conjunctivitis, rhinitis, and bronchial asthma) all have an impact on sleep quality. The association between sleep quality and AD during its exacerbations and remission stages may require further investigation through follow-up research.	NM	Moderate
Abdullateef, 2014 [24]	Saudi patients' infants' dermatitis quality of life (IDQoL) was negatively impacted by AD symptoms, which were also positively connected with the illness severity score.	NM	High

The experts concurred that dermatologists and pediatricians frequently meet AD; nevertheless, it is still in its early stages in Saudi Arabia. Patients with AD prefer specialist medical consultations over those with a family doctor or general practitioner. This may be a contributing reason to lengthy waiting lists, potential delays in diagnosis, and appropriate management [28]. A survey conducted in Jeddah also revealed that family physicians in Saudi Arabia had several misconceptions about treating dermatological disorders, including apprehension about giving topical corticosteroids. This was caused by the fact that their only source of dermatology information was their undergraduate education [29]. Since family physicians are typically sought out for initial diagnosis and treatment in Saudi Arabia, the expert panel advised that they be involved in the evaluation of suspected children with a family history of atopy, especially in patients with isolated lesions [30, 31].

Our review demonstrated that children with AD experienced a decrease in their QoL. Although the possibility that itch sensation, skin barrier damage, and ultimately AD is linked to psychiatric disease cannot be ruled out, it is more likely that the stress of chronic and intermittent disease, itch, disrupted sleep, and social isolation have a detrimental effect on mental health [32]. For instance, pruritus in AD can affect both children's sleep quality, with difficulty falling asleep and frequent nighttime awakenings contributing to the emergence of sadness and anxiety [33]. Potentially adding to the burden of psychiatric disease is social stigmatization brought on by obvious skin blemishes [34].

Some studies reported bacterial infections, streptococcal, and gram-negative bacterial colonization complicated atopic dermatitis in children [23, 25, 26]. Streptococci, particularly -hemolytic Streptococci, are uncommon on healthy skin [35]. Except for temporary residents of the skin, gram-negative organisms are uncommon in the regular skin flora [36]. It has been widely documented that S. aureus colonizes atopic patients, and some early investigations estimated colonization rates of over 90% [37]. According to some studies, the colonization rate varies between 30 and 100% depending on several variables, including sample size, patient type, disease severity, use of antibiotics, patient age, and methods for detection and data analysis [38].

One study reported ocular abnormalities, which primarily included lid and corneal abnormalities [22]. Ocular problems might start acutely or gradually, and the majority of them could eventually damage vision if they are not properly identified and treated [39]. Numerous factors, such as immunological dysregulation, heredity, frequent eye rubbing, and drug adverse effects, are linked to ocular complications [40].

The current status of dermatitis and related atopic diseases has an impact on sleep quality [27]. To preserve biopsychosocial and cultural function, sleep is an essential human need. When you wake up feeling energized after sleeping, you have a good night's sleep. When you do not, you have sleeping problems [41]. As a result of significant pruritus-related sleep disturbance in AD patients, affected people's functional abilities are impaired, which lowers their quality of life. The early identification and effective management of sleep disturbances should therefore be a top priority in children with AD [42].

The included studies reported using daily skin regimens in addition to systematic treatment; corticosteroids, and antihistamines [19, 22]. Although the pathophysiology of AD is widely understood, there is little agreement regarding routine care procedures [43]. The recommendations that are currently available are centered on adult AD; as a result, a Saudi Arabian expert panel of dermatologists and pediatricians was assembled to reach a consensus on the unmet needs for the diagnosis and therapy of pediatric AD and the significance of appropriate referral guidance. These guidelines ought to include therapeutic objectives (endpoints, time points), eligibility requirements for topical medications,

including nonsteroidal topical medicines, and monitoring standards for systemic therapy responses [44]. It is crucial to implement a long-term therapeutic plan that includes patient education, trigger avoidance, appropriate skincare, compliance with pharmacological treatments, and non-pharmacological interventions [45]. The experts agreed that multiple methods are used by family doctors, dermatologists, pediatricians, allergists, and immunologists to treat atopic dermatitis in children. Additionally, parents, caregivers, and providers should be involved in the decision-making process for pediatric AD treatment. Its goals are to minimize exacerbations such as pruritus and dermatitis and to guard against therapeutic risks. During the joint decision-making process, it is important to take into account the treatment's goals and expectations, a strategy for achieving them, potential risks and benefits, the impact of linked comorbidities, and parental preferences. The panel of experts concurred that Saudi Arabia still lacks treatment recommendations [46].

Conclusion

In this systematic review, we found that most AD patients experienced a decrease in their QoL. Bacterial colonization was relatively common among AD patients. Shared decision-making amongst the parents/caregivers, various specialties, and professionals should be the foundation of pediatric AD treatment. Emollient therapy should be advised after a careful evaluation of the severity. To create a national standard encompassing all stakeholders' thoughts and proposals, multidisciplinary collaboration is required.

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References

1. Krakowski AC, Eichenfield LF, Dohil MA. Management of atopic dermatitis in the pediatric population. Pediatrics. 2008;122(4):812-24.
2. Kowalska-Olędzka E, Czarnecka M, Baran A. Epidemiology of atopic dermatitis in Europe. J Drug Assess. 2019;8(1):126-8.
3. Mennini M, Di Nardo G, Fiocchi AG. Atopic dermatitis: time for tailored therapy. Lancet. 2022;400(10348):252-3.
4. Nejatisafa AA, Faccio F, Nalini R. Psychological aspects of pregnancy and lactation in patients with breast cancer. Diseases of the Breast during Pregnancy and Lactation. 2020:199-207.
5. Fishbein AB, Silverberg JI, Wilson EJ, Ong PY. Update on Atopic Dermatitis: Diagnosis, Severity Assessment, and Treatment Selection. J Allergy Clin Immunol Pract. 2020;8(1):91-101. doi:10.1016/j.jaip.2019.06.044
6. Gür Çetinkaya P, Şahiner ÜM. Childhood atopic dermatitis: current developments, treatment approaches, and future expectations. Turk J Med Sci. 2019;49(4):963-84. doi:10.3906/sag-1810-105
7. Todorov A, Torah R, Ardern-Jones MR, Beeby SP. Electromagnetic Sensing Techniques for Monitoring Atopic Dermatitis-Current Practices and Possible Advancements: A Review. Sensors (Basel). 2023;23(8):3935. doi:10.3390/s23083935
8. Huang A, Cho C, Leung DYM, Brar K. Atopic Dermatitis: Early Treatment in Children. Curr Treat Options Allergy. 2017;4(3):355-69. doi:10.1007/s40521-017-0140-6
9. Bacci E, Rentz A, Correll J, Pierce E, DeLozier A, Rueda M, et al. Patient-Reported Disease Burden and Unmet Therapeutic Needs in Atopic Dermatitis. J Drugs Dermatol. 2021;20(11):1222-30. doi:10.36849/jdd.6329
10. Bylund S, Kobyletzki LB, Svalstedt M, Svensson Å. Prevalence and Incidence of Atopic Dermatitis: A Systematic Review. Acta Derm Venereol. 2020;100(12):adv00160. doi:10.2340/00015555-3510
11. Fatani MI, Al Sheikh AA, Alajlan MA, Alharithy RS, Binamer Y, Albarakati RG, et al. National Saudi consensus statement on the management of atopic dermatitis (2021). Dermatol Ther. 2022;12(7):1551-75.
12. Chatrath S, Silverberg JI. Phenotypic differences of atopic dermatitis stratified by age. JAAD Int. 2023;11:1-7.
13. Wollenberg A, Barbarot S, Bieber T, Christen-Zaech S, Deleuran M, Fink-Wagner A, et al. Consensus-based European guidelines for treatment of atopic eczema (atopic dermatitis) in adults and children: part I. J Eur Acad Dermatol Venereol. 2018;32(5):657-82.
14. Wollenberg A, Oranje A, Deleuran M, Simon D, Szalai Z, Kunz B, et al. ETFAD/EADV Eczema task force 2015 position paper on diagnosis and treatment of atopic dermatitis in adult and paediatric patients. J Eur Acad Dermatol Venereol. 2016;30(5):729-47.
15. European Medicines Agency. Committee for Medicinal Products for human use, post authorisation summary of positive opinion for dupixent EMA/CHMP/535576/2020. 2021. Available from: https://www.ema.eur-opa.eu/en/documents/smop/chmp-post-authorisation-sum-mary-positive-opinion-dupixent-ii-27_en.pdf (Accessed 10 June 2023).
16. Tugwell P, Tovey D. PRISMA 2020. J Clin Epidemiol. 2021;134:A5-6.
17. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. Syst Rev. 2016;5:1-0.
18. Jüni P, Loke Y, Pigott T, Ramsay C, Regidor D, Rothstein H, et al. Risk of bias in non-randomized studies of interventions (ROBINS-I): detailed guidance. Br Med J. 2016;355:i4919.
19. Aldosari BM, Shadid AM, Alekrish KA, Alreshidi IG, Alturki AY, Al Sulaiman MA, et al. Childhood Atopic Dermatitis: A Nationwide Measurement of Quality of Life among Saudi Patients. Saudi J Med Med Sci. 2023;11(2):157.
20. Alzolibani AA. Impact of atopic dermatitis on the quality of life of Saudi children. Saudi Med J. 2014;35(4):391-6.
21. A Al Robaee A, Shahzad M. Impairment quality of life in families of children with atopic dermatitis. Acta dermatovenerol Croat. 2010;18(4):0-.
22. Raffa LH, Roblah TM, Balbaid NT, Zimmo BS, Showail MJ. Ocular manifestations of children with atopic dermatitis in Saudi Arabia. Int J Ophthalmol. 2023;16(5):787.
23. Bilal JA, Ahmad MI, Al Robaee AA, Alzolibani AA, Al Shobaili HA, Al-Khowailed MS. Pattern of bacterial colonization of atopic dermatitis in Saudi children. J Clin Diagn Res. 2013;7(9):1968.
24. Alzolibani AA. Impact of atopic dermatitis on the quality of life of Saudi children. Saudi Med J. 2014;35(4):391-6.
25. Alkahtani AM, Al Amer E, Bahamdan KA, Almaghrabi MK, Alshahrani MY, Elfaki ME, et al. Microbial Colonization in Atopic Dermatitis and its Associated Risk Factors in Children from Aseer Region, Saudi Arabia. Bahrain Med Bull. 2022;44(2).
26. Alenizi DA. Prevalence of Staphylococcus aureus and antibiotic resistance in children with atopic dermatitis in Arar, Saudi Arabia. J Dermatol Dermatol Surg. 2014;18(1-2):22-6.
27. Mahmoud MI, Algarni MA, Wedad HA, Bawarith BM, Bawarith AM, Abrar TA. Atopic dermatitis and sleep quality among preschool children in Jeddah, Saudi Arabia. Med Sci. 2020;24(102):927-34.
28. Al-Afif KA, Buraik MA, Buddenkotte J, Mounir M, Gerber R, Ahmed HM, et al. Understanding the burden of atopic dermatitis in Africa and the Middle East. Dermatol Ther. 2019;9:223-41.
29. Kokandi AA. Family medicine trainees' knowledge about topical corticosteroids in Jeddah, Saudi Arabia. Open Dermatol J. 2019;13(1).
30. Almalki RA, Bardisi W. Knowledge about Atopic Dermatitis among Primary Health Care Physicians in Jeddah 2017. 2019.

31. A Kokandi A. Patterns of clinical management of atopic eczema among dermatologists and other specialties. Al-Azhar Med J. 2018;47(3):551-60.
32. Matthews T, Danese A, Wertz J, Odgers CL, Ambler A, Moffitt TE, et al. Social isolation, loneliness and depression in young adulthood: a behavioural genetic analysis. Soc Psychiatry Psychiatr Epidemiol. 2016;51:339-48.
33. Yu SH, Attarian H, Zee P, Silverberg JI. Burden of sleep and fatigue in US adults with atopic dermatitis. Dermatitis. 2016;27(2):50-8.
34. Alamri A, Alshareef M, Aljoudi SB, Assaedi L, Alkassimi S, Algethami A, et al. Patterns of Dermatological Diseases in Inpatient Consultations at King Abdulaziz Medical City, Jeddah, Saudi Arabia: An Underexploited Opportunity for Dermatology Clinical Training. Cureus. 2022;14(2):e22132. doi:10.7759/cureus.22132
35. Lee SL, Pearce E, Ajnakina O, Johnson S, Lewis G, Mann F, et al. The association between loneliness and depressive symptoms among adults aged 50 years and older: a 12-year population-based cohort study. Lancet Psychiatry. 2021;8(1):48-57. doi:10.1016/S2215-0366(20)30383-7
36. Paller AS, Kong HH, Seed P, Naik S, Scharschmidt TC, Gallo RL, et al. The microbiome in patients with atopic dermatitis. J Allergy Clin Immunol. 2019;143(1):26-35. doi:10.1016/j.jaci.2018.11.015
37. Shi B, Bangayan NJ, Curd E, Taylor PA, Gallo RL, Leung DY, et al. The skin microbiome is different in pediatric versus adult atopic dermatitis. J Allergy Clin Immunol. 2016;138(4):1233-6.
38. Shi B, Bangayan NJ, Curd E, Taylor PA, Gallo RL, Leung DY, et al. The skin microbiome is different in pediatric versus adult atopic dermatitis. J Allergy Clin Immunol. 2016;138(4):1233-6.
39. Hsu JI, Pflugfelder SC, Kim SJ. Ocular complications of atopic dermatitis. Cutis. 2019;104(3):189-93.
40. Carmi E, Defossez-Tribout C, Ganry O, Cene S, Tramier B, Milazzo S, et al. Ocular complications of atopic dermatitis in children. Acta derm-venereol. 2006;86(6):515-7.
41. Karimy M, Parvizi F, Rouhani MR, Griffiths MD, Armoon B, Fattah Moghaddam L. The association between internet addiction, sleep quality, and health-related quality of life among Iranian medical students. J Addict Dis. 2020;38(3):317-25. doi:10.1080/10550887.2020.1762826
42. Lei DK, Yousaf M, Janmohamed SR, Vakharia PP, Chopra R, Sacotte R, et al. Validation of Patient-Reported Outcomes Information System Sleep Disturbance and Sleep-Related Impairment in adults with atopic dermatitis. Br J Dermatol. 2020;183(5):875-82. doi:10.1111/bjd.18920
43. Thyssen JP, Berents T, Bradley M, Deleuran M, Grimstad O, Korhonen L, et al. Clinical management of atopic dermatitis in adults: mapping of expert opinion in 4 Nordic countries using a modified Delphi process. Acta Derm-Venereol. 2020.
44. Bieber T. Atopic dermatitis: an expanding therapeutic pipeline for a complex disease. Nat Rev Drug Discov. 2022;21(1):21-40.
45. Osborne SR, Alston LV, Bolton KA, Whelan J, Reeve E, Wong Shee A, et al. Beyond the black stump: rapid reviews of health research issues affecting regional, rural and remote Australia. Med J Aust. 2020;213 Suppl 11:S3-S32. doi:10.5694/mja2.50881
46. Alradaddi A, Al Twaim A, Abu-aliat A, Al-Atass K, Alogayell L, Aldayil M, et al. Unmet Medical Needs and Early Referral of Pediatric Atopic Dermatitis: An Expert Modified Delphi Consensus from Saudi Arabia. Dermatol Res Pract. 2022;2022.