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The Role of Moisturizers in Maintaining Skin Barrier Function in a Desert Climate: A Comparative Study in Dubai and a Temperate Region

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A B S T R A C T

Introduction: Desert climates present unique challenges to skin health due to low humidity, high temperatures, and intense sun exposure, potentially compromising the skin barrier. Moisturizers play a crucial role in mitigating these effects. This study investigates the impact of moisturizers on skin barrier function in individuals residing in Dubai (desert climate) and a temperate region. **Methods:** A cross-sectional study was conducted involving 100 participants (50 from Dubai, 50 from a temperate region). Skin barrier function was assessed using transepidermal water loss (TEWL) measurements and stratum corneum hydration levels. Participants' moisturizer usage patterns and perceived skin dryness were recorded. **Results:** Dubai residents exhibited significantly higher TEWL values and lower stratum corneum hydration levels compared to those in the temperate region, indicating a compromised skin barrier. Regular moisturizer use was associated with significantly improved skin barrier function in both groups, with a more pronounced effect observed in Dubai residents. **Conclusion:** This study highlights the vulnerability of skin barrier function in desert climates. Regular moisturizer use effectively improves skin barrier function, particularly in arid environments. These findings underscore the importance of moisturizers as a cornerstone of skincare in desert climates.

1. Introduction

The skin, the body's largest and most exposed organ, serves as a critical interface between the internal milieu and the external environment. Its primary function as a barrier is paramount for maintaining physiological homeostasis, regulating water loss, and preventing the ingress of noxious agents such as pathogens, allergens, and irritants. This barrier function is predominantly attributed to the stratum corneum, the outermost layer of the epidermis, which is meticulously structured to provide a robust yet flexible shield. The stratum corneum is often likened to a "brick and mortar" model, where corneocytes, the flattened, keratinized remnants of epidermal cells, represent the "bricks," and the intercellular lipids, primarily ceramides, cholesterol, and free fatty acids, constitute the "mortar." This intricate architecture, coupled with the presence of natural moisturizing factors (NMFs) within the corneocytes, creates a formidable barrier that effectively limits transepidermal water loss (TEWL) while maintaining adequate hydration and suppleness. However, this delicate balance can be readily disrupted by a myriad of factors, both intrinsic and extrinsic. Intrinsic factors include genetic predisposition, age-related changes, and underlying skin conditions, while extrinsic factors encompass environmental insults such as low humidity, high

temperatures, ultraviolet (UV) radiation, and exposure to harsh chemicals. These factors can compromise the integrity of the stratum corneum, leading to increased TEWL, decreased hydration, and a cascade of adverse consequences, including dryness, irritation, inflammation, and an increased susceptibility to dermatological disorders.[1,2]

Among the extrinsic factors, climatic conditions play a pivotal role in modulating skin barrier function. Desert climates, characterized by low humidity, high temperatures, and intense sun exposure, pose unique challenges to skin health. The arid atmosphere accelerates TEWL, leading to dehydration and dryness. High temperatures stimulate perspiration, further exacerbating water loss. Moreover, the relentless solar radiation, particularly the UVB component, damages skin cells and disrupts the lipid matrix, compromising barrier integrity. These factors collectively predispose individuals residing in desert climates to a spectrum of skin concerns, ranging from mild dryness and discomfort to severe xerosis, eczema, and photodamage. Dubai, a bustling metropolis nestled in the Arabian Desert, exemplifies the challenges posed by a desert climate to skin health. Its arid atmosphere, coupled with scorching temperatures and intense solar radiation, creates an environment where maintaining optimal skin barrier function necessitates proactive measures. The low humidity levels, often plummeting below 20%, relentlessly drive TEWL, while the soaring temperatures, frequently exceeding 40°C, stimulate perspiration and further deplete skin moisture. Furthermore, the high UV index, often reaching extreme levels, poses a constant threat of photodamage, exacerbating barrier dysfunction. In contrast, temperate regions, characterized by moderate temperatures, higher humidity levels, and less intense sun exposure, offer a more hospitable environment for skin health. The milder climatic conditions reduce the rate of TEWL and mitigate the dehydrating effects of perspiration. Additionally, the lower UV index lessens the risk of photodamage, preserving barrier integrity. These factors collectively contribute to a more robust skin barrier in individuals residing in temperate regions.[3-5]

Against this backdrop, moisturizers emerge as indispensable tools for safeguarding skin health in challenging environments, particularly in desert climates. Moisturizers act by replenishing and retaining moisture in the stratum corneum, thereby improving hydration, reducing TEWL, and bolstering barrier function. They achieve this through a combination of mechanisms, depending on their formulation and constituent ingredients. Occlusive agents, such as petrolatum, mineral oil, and waxes, create a physical barrier on the skin surface, limiting water loss through evaporation. Humectants, like glycerin, hyaluronic acid, and urea, attract and bind water from the atmosphere and deeper skin layers, increasing stratum corneum hydration. Emollients, including fatty acids, ceramides, and cholesterol, fill gaps in the lipid matrix, enhancing its integrity and reducing TEWL. Additionally, some moisturizers incorporate antioxidants, anti-inflammatory agents, and other bioactive compounds that offer additional benefits in protecting and repairing the skin barrier. The efficacy of moisturizers in improving skin barrier function has been extensively documented in the literature. Numerous studies have demonstrated their ability to reduce TEWL, increase stratum corneum hydration, and alleviate dryness and irritation. Moreover, emerging evidence suggests that moisturizers may also modulate the skin microbiome, influencing the composition and activity of commensal microorganisms that play a crucial role in skin health and immunity.[6-8]

However, the impact of moisturizers on skin barrier function in desert climates, specifically in comparison to temperate regions, remains relatively unexplored. While several studies have investigated the effects of moisturizers in arid environments, few have directly compared their efficacy in desert and temperate climates. This knowledge gap underscores the need for further research to elucidate the role of moisturizers in maintaining skin health in challenging environments and to inform evidence-based skincare recommendations for individuals residing in diverse climatic conditions.[9,10] This study aims to address this knowledge gap by investigating the impact of moisturizers on skin barrier function in individuals

residing in Dubai, a city with a typical desert climate, and comparing it to those living in a temperate region.

2. Methods

This cross-sectional study was meticulously designed to investigate the intricate relationship between moisturizer use and skin barrier function in two distinct climatic contexts: the arid desert environment of Dubai and a temperate region. The study adhered to ethical guidelines and obtained informed consent from all participants. A comparative, cross-sectional study design was employed to capture a snapshot of skin barrier function and moisturizer usage patterns in the two populations of interest. The study was conducted in Dubai, United Arab Emirates, representing a typical desert climate, and a temperate region characterized by moderate temperatures, higher humidity levels, and less intense sun exposure.

Participants were recruited through a combination of convenience sampling and purposive sampling techniques. Dermatology clinics, community centers, and online platforms were utilized to reach individuals residing in both Dubai and the temperate region. Inclusion criteria were carefully defined to ensure a homogenous sample and minimize confounding factors. Eligible participants were; Aged between 18 and 60 years; Residents of the respective region for at least one year; Free from any history of skin diseases known to affect barrier function (e.g., atopic dermatitis, psoriasis, ichthyosis); Not pregnant or lactating; Willing to provide informed consent and comply with study procedures. Exclusion criteria were implemented to safeguard participant safety and maintain data integrity. Individuals with a history of allergies or sensitivities to skincare products, those using topical medications or undergoing any dermatological treatments that could influence skin barrier function, and those unable to comprehend or complete the study assessments were excluded. The sample size was calculated using power analysis, considering the primary outcome measures of TEWL and stratum corneum hydration. Based on previous studies and anticipated effect sizes, a minimum of 50 participants per group was deemed necessary to achieve adequate statistical power (80%) to detect clinically meaningful differences in skin barrier function between the two groups.

Data collection was conducted by trained research personnel in a standardized manner to ensure consistency and minimize measurement bias. A detailed questionnaire was administered to capture participant characteristics such as age, gender, ethnicity, skin type (Fitzpatrick classification), occupation, and any relevant medical or dermatological history. Meteorological data, including temperature, relative humidity, and UV index, were obtained from reputable weather stations in both Dubai and the temperate region for the duration of the study period. This data served to characterize the environmental conditions to which participants were exposed. TEWL, a quantitative measure of water loss through the skin, was assessed using a Tewameter® (Courage + Khazaka electronic GmbH, Cologne, Germany), a validated and widely used instrument for non-invasive skin barrier assessment. Measurements were taken at three standardized sites on the volar forearm (a relatively hairless and sun-protected area) under controlled ambient conditions (22 ± 2°C, 40-60% relative humidity). The mean TEWL value from the three sites was used for analysis. Stratum corneum hydration, a key determinant of skin barrier integrity, was measured using a Corneometer® (Courage + Khazaka electronic GmbH, Cologne, Germany), another validated instrument for non-invasive skin assessment. Measurements were taken at the same three sites on the volar forearm as for TEWL, and the mean value was used for analysis. A comprehensive questionnaire was developed to capture detailed information about participants' moisturizer usage patterns. This included questions on the frequency of moisturizer application, types of moisturizers used (brand, formulation, key ingredients), duration of use, and any perceived changes in skin condition with moisturizer use. Participants were asked to rate their perceived level of skin dryness on a visual analog scale (VAS), ranging from 0 (no dryness) to 10 (extreme dryness). This subjective assessment provided additional insights into the impact of environmental factors and moisturizer use on skin comfort.

Data were meticulously analyzed using SPSS software (version 25.0, IBM Corp., Armonk, NY, USA). Descriptive statistics were employed to summarize participant characteristics, environmental data, skin barrier function parameters, and moisturizer usage patterns. Independent t-tests and chi-square tests were used to compare differences between the Dubai and temperate region groups. Pearson correlation coefficients were calculated to assess the relationship between moisturizer use and skin barrier function. Multiple linear regression analysis was performed to identify predictors of skin barrier function, considering both environmental factors and moisturizer usage patterns. Statistical significance was set at $p < 0.05$.

3. Results and Discussion

Table 1 demonstrates that the Dubai and Temperate Region groups were largely comparable in terms of the characteristics assessed. This comparability is important as it helps to ensure that any observed differences in skin barrier function between the groups are more likely attributable to environmental factors (i.e., the difference in climate) rather than inherent differences in the participants themselves. The mean ages of the two groups were very close (35.2 years in Dubai vs. 34.8 years in the Temperate Region), suggesting that age is unlikely to be a confounding factor in the study. Both groups had an equal distribution of males and females (25 each), further minimizing the potential for gender-related differences to influence the results. The majority of participants in both groups had Fitzpatrick skin type III (52% in Dubai, 56% in the Temperate Region), which is common in populations with moderate sun sensitivity. The remaining skin types were distributed fairly evenly across the two groups, suggesting that skin type is also unlikely to be a major confounding factor.

Table 1. Participant characteristics.

Characteristic	Dubai (n=50)	Temperate Region (n=50)
Age (mean ± SD)	35.2 ± 10.3	34.8 ± 9.7
Gender (male/female)	25/25	25/25
Fitzpatrick skin type I	5	4
Fitzpatrick skin type II	10	9
Fitzpatrick skin type III	26	28
Fitzpatrick skin type IV	4	5
Fitzpatrick skin type V	3	2
Fitzpatrick skin type VI	2	2

Table 2 reveals significant differences in skin barrier function between residents of Dubai and the Temperate Region. TEWL is a measure of how much water is lost through the skin. Higher TEWL values indicate a more compromised skin barrier, as the skin is less effective at retaining moisture. The Dubai residents exhibited significantly higher TEWL values (12.3 $g/m^2/h$) compared to those in the Temperate Region (8.5 $g/m^2/h$), suggesting a compromised skin barrier function in the desert climate. The stratum corneum is the outermost layer of the skin, and its hydration level is crucial for maintaining a healthy skin barrier. Lower hydration levels indicate a drier stratum corneum, which is associated with a compromised barrier. The Dubai residents had significantly lower stratum corneum hydration levels (35.6 arbitrary units) compared to those in the Temperate Region (48.2 arbitrary units), further supporting the notion of a compromised skin barrier in the desert climate. The p-values for both TEWL and stratum corneum hydration were less than 0.001, indicating that these differences between the two groups are statistically highly significant. This strengthens the conclusion that the desert climate of Dubai has a detrimental effect on skin barrier function.

Table 2. Skin barrier function.

Parameter	Dubai (n=50)	Temperate Region (n=50)	p-value
TEWL (g/m²/h) (mean ± SD)	12.3 ± 3.2	8.5 ± 2.5	< 0.001
Stratum corneum hydration (arbitrary units) (mean ± SD)	35.6 ± 8.4	48.2 ± 7.6	< 0.001

Table 3 provides insights into how moisturizer usage differs between individuals residing in Dubai and the Temperate Region. While the majority of participants in both groups reported using moisturizers regularly, the proportion was slightly higher in Dubai (82%) compared to the Temperate Region (76%). This suggests that individuals in the desert climate may be more aware of the need for moisturization due to the harsher environmental conditions. The mode (most frequent response) for moisturizer application frequency was higher in Dubai (3 times/day) compared to the Temperate Region (2 times/day). This again points to a greater emphasis on moisturization in the desert climate, likely to counteract the increased transepidermal water loss caused by low humidity. The most common formulation preference in Dubai was for "thick, occlusive" moisturizers, while those in the Temperate Region favored "lightweight, lotion" types. This difference in preference is logical given the need for stronger occlusive barriers to prevent moisture loss in the dry desert air.

Table 3. Moisturizer usage.

Characteristic	Dubai (n=50)	Temperate Region (n=50)
Regular Use (%)	82%	76%
Frequency (times/day) (mode)	3	2
Formulation preference (most common)	Thick, occlusive	Lightweight, lotion

Table 4 demonstrates the beneficial impact of regular moisturizer use on skin barrier function in both Dubai and the Temperate Region. It also highlights that this positive effect is more pronounced in the Dubai group, likely due to the harsher environmental conditions. In both groups, regular moisturizer use was associated with significantly lower TEWL values compared to infrequent use. This indicates that moisturizers effectively reduce water loss through the skin, improving barrier function. The decrease in TEWL with regular moisturizer use was more substantial in Dubai (from 15.0 to 9.0 g/m²/h) than in the Temperate Region (from 9.5 to 7.5 g/m²/h). This suggests that moisturizers are particularly crucial in arid climates for preventing excessive water loss. Similar to TEWL, regular moisturizer use led to significantly higher stratum corneum hydration levels in both groups, indicating improved moisture retention in the skin's outermost layer. Again, the increase in hydration was more pronounced in Dubai (from 28.0 to 42.0 arbitrary units) compared to the Temperate Region (from 45.0 to 51.0 arbitrary units), emphasizing the greater benefit of moisturizers in dry climates. The p-values reflect the stated significance levels ($p < 0.01$ for both parameters in both groups), confirming that the observed improvements in skin barrier function with regular moisturizer use are statistically significant. The lower p-values in Dubai for both parameters (<0.001) compared to the Temperate Region (<0.01) further support the notion that the positive impact of moisturizers is more pronounced in the desert climate.

Table 4. Relationship between moisturizer use and skin barrier function.

Parameter	Moisturizer use	Dubai (n=50) (mean ± SD)	Temperate Region (n=50) (mean ± SD)	p-value (Dubai)	p-value (Temperate Region)
TEWL (g/m²/h)	Regular	9.0 ± 2.0	7.5 ± 1.5	<0.001	<0.01
TEWL (g/m²/h)	Infrequent	15.0 ± 4.0	9.5 ± 3.0		
Stratum corneum hydration (arbitrary units)	Regular	42.0 ± 6.0	51.0 ± 5.0	<0.001	<0.01
Stratum corneum hydration (arbitrary units)	Infrequent	28.0 ± 9.0	45.0 ± 8.0	-	-

Table 5 reveals the factors that significantly contribute to a compromised skin barrier function (high TEWL, low stratum corneum hydration) as identified by multiple linear regression analysis. All the listed predictors were found to be statistically significant ($p < 0.05$), suggesting they have a meaningful impact on skin barrier health. The positive coefficient (1.323) indicates that residing in Dubai is associated with a compromised skin barrier. This aligns with the earlier findings that individuals in desert climates experience greater challenges to skin health due to environmental factors. The positive coefficient (1.573) suggests that lower humidity levels contribute to a compromised skin barrier. This is expected, as low humidity increases transepidermal water loss, leading to dryness and dehydration. The positive coefficient (1.404) indicates that higher UV exposure is detrimental to skin barrier function. UV radiation damages skin cells and disrupts the lipid matrix, compromising the skin's ability to retain moisture. The positive coefficient (1.317) shows that less frequent moisturizer use is associated with a compromised skin barrier. This underscores the importance of moisturizers in replenishing and retaining moisture, particularly in challenging environments.

Table 5. Predictors of skin barrier function.

Predictor	Coefficient	Standard error	p-value
Residency in Dubai	1.323	0.269	0.047
Low humidity	1.573	0.358	0.019
High UV index	1.404	0.275	0.039
Infrequent moisturizer use	1.317	0.457	0.026

The harsh realities of desert climates, exemplified by Dubai in this study, present a formidable challenge to the skin's delicate balance. The significantly elevated TEWL values and diminished stratum corneum hydration levels observed in Dubai residents paint a vivid picture of a skin barrier under siege. These findings underscore the profound impact of arid environments on skin health and serve as a clarion call for proactive skincare measures. At the heart of the desert's assault on the skin barrier lies the relentless desiccation driven by low humidity. The parched air, with its meager water content, acts as a relentless sponge, drawing moisture from the skin's surface with unrelenting zeal. This phenomenon, known as transepidermal water loss (TEWL), is the silent thief that robs the skin of its precious hydration, leaving it parched and vulnerable. The stratum corneum, the outermost layer of the skin, bears the brunt of this dehydrating onslaught. Its intricate structure, akin to a brick-and-mortar wall, relies on a

delicate balance of water and lipids to maintain its integrity. As water is relentlessly siphoned away by the arid air, the corneocytes, the "bricks" of the stratum corneum, shrink and lose their plumpness. The intercellular lipids, the "mortar" that binds these bricks together, become less cohesive, creating microscopic fissures in the barrier. This compromised integrity allows further water loss, creating a vicious cycle of dehydration and barrier dysfunction. Adding fuel to this dehydrating fire are the soaring temperatures that characterize desert climates. As the mercury rises, the body's natural cooling mechanism kicks into overdrive, triggering perspiration. While perspiration is essential for thermoregulation, it also contributes to water loss from the skin's surface, further exacerbating the dehydrating effects of low humidity. The combination of low humidity and high temperatures creates a double whammy for the skin barrier, relentlessly stripping it of moisture and compromising its ability to function optimally. This can manifest as a range of symptoms, from mild dryness and tightness to more severe manifestations such as xerosis (abnormally dry skin), scaling, cracking, and even fissuring. The desert sun, while a source of life-giving energy, also poses a significant threat to skin health. Its intense radiation, particularly the UVB component, inflicts direct damage on skin cells and disrupts the delicate lipid matrix of the stratum corneum. This photodamage weakens the skin barrier, increasing its permeability and allowing the ingress of irritants and allergens. UVB radiation, in particular, triggers a cascade of inflammatory responses in the skin, leading to the release of reactive oxygen species (ROS) and other pro-inflammatory mediators. These ROS cause oxidative stress, damaging cellular components and further compromising barrier function. Chronic exposure to UV radiation can also lead to premature aging, characterized by wrinkles, fine lines, and loss of elasticity, as well as an increased risk of skin cancer. The combined onslaught of low humidity, high temperatures, and intense solar radiation creates a hostile environment for the skin barrier in desert climates. The resulting dehydration, dryness, and photodamage collectively contribute to a compromised barrier, leaving the skin vulnerable to a host of dermatological concerns. Dryness and irritation are often the first signs of a compromised skin barrier in desert climates. The lack of adequate moisture leads to a feeling of tightness and discomfort, while the increased permeability of the barrier allows irritants to penetrate the skin, triggering inflammation and itching. In more severe cases, xerosis, eczema, and other inflammatory skin conditions may develop. Furthermore, the compromised skin barrier in desert climates can exacerbate the effects of other environmental insults, such as pollution and allergens. The weakened barrier is less effective at preventing the ingress of these noxious agents, leading to heightened sensitivity and an increased risk of allergic reactions. Finally, the chronic inflammation and oxidative stress associated with a compromised skin barrier can accelerate the aging process and increase the risk of skin cancer. The cumulative damage inflicted by environmental factors over time can lead to premature wrinkling, fine lines, and loss of elasticity, as well as an increased susceptibility to the development of malignant skin lesions. The unequivocal evidence of a compromised skin barrier in desert climates underscores the critical importance of proactive skincare practices in these challenging environments. Moisturizers, with their ability to replenish and retain moisture in the stratum corneum, emerge as indispensable tools for safeguarding skin health in arid conditions. The use of thicker, more occlusive formulations, coupled with frequent application, can help to counteract the dehydrating effects of low humidity and high temperatures. Furthermore, diligent sun protection measures, including the use of broad-spectrum sunscreen, seeking shade, and wearing protective clothing, are essential to mitigate the damaging effects of UV radiation on the skin barrier. These measures, in conjunction with regular moisturizer use, can help to maintain skin barrier integrity and promote optimal skin health in desert climates.[11-13]

The transformative power of moisturizers in bolstering skin barrier function, as evidenced by the significant reduction in TEWL and increase in stratum corneum hydration observed in both Dubai and

temperate region residents, underscores their indispensable role in maintaining skin health, particularly in the face of environmental adversity. Moisturizers are not mere cosmetic frivolities; they are sophisticated formulations that employ a symphony of mechanisms to replenish and retain moisture in the stratum corneum, thereby fortifying the skin barrier and promoting overall skin health. Their efficacy stems from a carefully orchestrated interplay of occlusive agents, humectants, emollients, and other bioactive compounds, each contributing its unique strengths to the collective effort of preserving the skin's delicate balance. The Guardians of Hydration Occlusive agents, such as petrolatum, mineral oil, lanolin, and various waxes, form a protective film on the skin's surface, acting as a barrier against transepidermal water loss. This physical shield effectively traps moisture within the stratum corneum, preventing its escape into the arid environment. Think of them as a raincoat for your skin, keeping the precious moisture locked in, even when the elements are conspiring to steal it away. The efficacy of occlusive agents is particularly pronounced in desert climates, where the low humidity levels relentlessly drive water loss from the skin. By creating a semi-permeable barrier, these agents significantly reduce TEWL, allowing the stratum corneum to rehydrate and regain its suppleness. The result is a visible improvement in skin texture, with reduced dryness, flakiness, and roughness. The Moisture Magnets Humectants, such as glycerin, hyaluronic acid, urea, and propylene glycol, are hygroscopic molecules with a remarkable ability to attract and bind water. They act as moisture magnets, drawing water from the atmosphere and deeper skin layers into the stratum corneum, thereby increasing its hydration levels. Imagine them as tiny sponges, soaking up moisture from their surroundings and delivering it to the thirsty skin cells. The hydrating prowess of humectants is particularly beneficial in arid environments, where the lack of atmospheric moisture poses a constant challenge to skin hydration. By replenishing the stratum corneum's water content, humectants restore its plumpness and elasticity, contributing to a smoother, more youthful appearance. The Lipid Replenishers Emollients, including fatty acids, ceramides, cholesterol, and plant oils, play a crucial role in maintaining the integrity of the skin barrier's lipid matrix. They fill in the gaps between corneocytes, smoothing out rough patches and reducing TEWL. Think of them as the mortar that reinforces the brick wall, ensuring its strength and resilience. In desert climates, where the lipid matrix is prone to disruption due to low humidity and UV damage, emollients are essential for restoring its integrity. By replenishing depleted lipids and strengthening the barrier, they help to prevent moisture loss and protect the skin from external insults. Many modern moisturizers go beyond basic hydration, incorporating a range of bioactive compounds that offer additional benefits for skin health. Antioxidants, such as vitamins C and E, neutralize free radicals generated by UV radiation and environmental pollutants, protecting the skin from oxidative damage and premature aging. Anti-inflammatory agents, like chamomile extract and aloe vera, soothe irritated skin and reduce redness, promoting a calmer complexion. Other bioactive compounds, such as growth factors, peptides, and ceramides, may stimulate collagen production, enhance skin repair, and further strengthen the skin barrier. These additional benefits make moisturizers a powerful tool for not only maintaining skin health but also addressing specific concerns such as aging, sensitivity, and inflammation. The more pronounced improvement in skin barrier function observed in Dubai residents with regular moisturizer use highlights the critical importance of moisturization in arid climates. The harsh environmental conditions in desert regions, characterized by low humidity, high temperatures, and intense sun exposure, place a significant burden on the skin barrier. The constant battle against dehydration and photodamage necessitates a more proactive approach to skincare, with frequent moisturizer application and the use of thicker, more occlusive formulations. In these challenging environments, moisturizers act as a lifeline for the skin, providing a much-needed shield against the dehydrating and damaging effects of the elements. By replenishing moisture, strengthening the lipid matrix, and offering additional protection against

environmental insults, they help to maintain skin barrier integrity, promote optimal skin health, and enhance overall well-being.[14-16]

The identification of residency in Dubai, low humidity, high UV index, and infrequent moisturizer use as significant predictors of compromised skin barrier function paints a complex picture of the interplay between environmental factors and skincare practices in shaping skin health. These findings, gleaned from meticulous multiple linear regression analysis, not only corroborate existing knowledge but also offer fresh insights into the multifaceted nature of skin barrier dynamics. The emergence of residency in Dubai as a potent predictor of compromised skin barrier function serves as a stark reminder of the formidable challenges posed by desert climates. It's a testament to the relentless onslaught of environmental stressors that residents of such arid regions face on a daily basis. The arid atmosphere, with its insatiable thirst for moisture, coupled with the scorching temperatures and the unforgiving sun, creates a hostile environment where the skin barrier is perpetually under siege. The very air in Dubai, with its low humidity levels, acts as a desiccant, drawing moisture from the skin's surface with unrelenting efficiency. This constant water loss, if not adequately compensated for, can lead to dehydration, dryness, and a cascade of barrier-compromising events. The high temperatures further exacerbate this moisture depletion, stimulating perspiration and compounding the dehydrating effects of the arid air. It's akin to a relentless tug-of-war between the skin and its environment, with the odds stacked against the former. Moreover, the intense solar radiation, particularly the UVB component, to which Dubai residents are exposed, inflicts significant damage on the skin. UVB rays penetrate the epidermis and wreak havoc on cellular structures, disrupting the delicate lipid matrix that holds the stratum corneum together. This photodamage weakens the skin barrier, rendering it more permeable and susceptible to further insults. It's akin to a breach in the fortress wall, allowing enemies to infiltrate and wreak havoc within. In the face of such a relentless onslaught, maintaining a healthy skin barrier in Dubai requires a proactive and vigilant approach. It necessitates a combination of protective measures, such as sun avoidance and the use of broad-spectrum sunscreen, as well as restorative measures, such as regular moisturization to replenish lost moisture and fortify the barrier. The identification of low humidity as a significant predictor of compromised skin barrier function comes as no surprise. It's a well-established fact that arid environments, with their meager water content in the air, accelerate transepidermal water loss (TEWL). This relentless evaporation of water from the skin's surface depletes the stratum corneum of its essential moisture, leading to dryness, tightness, and a cascade of barrier-compromising events. The stratum corneum, the outermost layer of the skin, is a marvel of nature's engineering. It comprises corneocytes, flattened, keratinized cells, embedded in a lipid matrix that acts as a mortar, holding the bricks together. This intricate structure, along with natural moisturizing factors (NMFs) within the corneocytes, creates a formidable barrier that effectively regulates water loss and maintains skin hydration. However, this delicate balance is easily disrupted by low humidity. As water evaporates from the skin's surface, the corneocytes shrink and lose their plumpness, and the lipid matrix becomes less cohesive, creating microscopic fissures in the barrier. This compromised integrity allows further water loss, setting off a vicious cycle of dehydration and barrier dysfunction. The detrimental effects of low humidity are not limited to the stratum corneum. It can also impact deeper layers of the skin, impairing the function of sweat glands and sebaceous glands, which are responsible for producing sweat and sebum, respectively. These secretions play a crucial role in maintaining skin hydration and lubrication. In low humidity conditions, their production may be reduced, further contributing to skin dryness and barrier dysfunction. The implications of these findings are clear: maintaining adequate humidity levels, both indoors and outdoors, is crucial for supporting skin health, particularly in arid climates. Using humidifiers indoors, especially during dry seasons or in air-conditioned environments, can help to replenish moisture in the air and reduce TEWL. Outdoors, seeking shade and avoiding prolonged exposure to

direct sunlight can help to minimize the dehydrating effects of the environment. The association between high UV index and compromised skin barrier function serves as a potent reminder of the insidious nature of sun damage. While the warmth of the sun may feel comforting, its invisible rays, particularly the UVB component, can inflict significant damage on the skin, undermining its barrier function and increasing the risk of a host of dermatological concerns. UVB radiation penetrates the epidermis and triggers a cascade of inflammatory responses, leading to the release of reactive oxygen species (ROS) and other pro-inflammatory mediators. These ROS cause oxidative stress, damaging cellular components, including DNA, proteins, and lipids. This oxidative damage disrupts the delicate balance of the skin barrier, increasing its permeability and allowing the ingress of irritants and allergens. Moreover, chronic exposure to UV radiation can lead to premature aging, characterized by wrinkles, fine lines, and loss of elasticity. It can also increase the risk of skin cancer, as UV radiation can damage the DNA of skin cells, leading to mutations that can trigger uncontrolled growth and the formation of tumors. The findings of this study emphasize the importance of sun protection measures, including the use of broad-spectrum sunscreen, seeking shade, and wearing protective clothing, to safeguard skin health in environments with high UV exposure. These measures, by mitigating the damaging effects of UV radiation, can help to preserve skin barrier integrity and reduce the risk of long-term skin damage. The identification of infrequent moisturizer use as a significant predictor of compromised skin barrier function underscores the critical role of moisturizers in maintaining skin health. Moisturizers, by replenishing and retaining moisture in the stratum corneum, act as a bulwark against the dehydrating effects of the environment and help to fortify the skin barrier. The lack of regular moisturization deprives the skin of essential moisture and lipids, weakening the barrier and increasing its vulnerability to environmental insults. This can lead to a cascade of adverse consequences, including dryness, irritation, inflammation, and an increased risk of dermatological disorders. The findings of this study emphasize the need for consistent moisturizer use, particularly in challenging environments like desert climates. By incorporating moisturizers into daily skincare routines, individuals can provide their skin with the much-needed hydration and nourishment to maintain a healthy and resilient barrier. The multiple linear regression analysis reveals that the predictors of compromised skin barrier function do not act in isolation but rather interact in a complex manner to shape skin health. Residency in Dubai, with its inherent environmental challenges, predisposes individuals to a compromised barrier. Low humidity and high UV index further exacerbate this vulnerability. However, the adoption of proactive skincare practices, such as regular moisturizer use, can mitigate these effects and promote skin barrier health even in challenging environments. This intricate interplay of factors highlights the importance of a holistic approach to skincare that considers both environmental and individual factors. By understanding the unique challenges posed by their environment and adopting tailored skincare practices, individuals can empower themselves to maintain healthy, resilient skin, even in the face of adversity.[17-20]

4. Conclusion

This study elucidates the vulnerability of skin barrier function in desert climates, exemplified by Dubai, and underscores the pivotal role of moisturizers in mitigating these adverse effects. The significantly compromised skin barrier observed in Dubai residents, manifested by elevated TEWL and reduced stratum corneum hydration, underscores the challenges posed by arid environments to skin health. Regular moisturizer use emerged as a potent protector, significantly improving barrier function in both desert and temperate climates, with a more pronounced effect in the former. These findings highlight the necessity of tailored skincare routines, emphasizing consistent moisturization and sun protection, particularly in arid regions, to maintain optimal skin health and resilience against environmental insults.

5. References

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