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REVIEW

The Effects of Physical Activity on Skin Health: A Narrative Review

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Abstract: Physical activity (PA) is crucial for a healthy lifestyle and significantly impacts skin health by boosting blood circulation, skin cell metabolism, stress regulation and anti-inflammatory compound production. However, intense exercise or exercise without protective measures can negatively affect the skin, causing irritation, redness, and even skin cancer. This review compiles studies on the effects of physical activity on skin health. PA benefits skin health by enhancing blood flow, which boosts oxygen and nutrient delivery, leading to a healthier complexion. It also increases endorphin production, reducing stress and inflammation. Regular PA improves sleep, aiding skin cell repair through increased human growth hormone. To optimize the role of PA in promoting skin health, it is essential to monitor individual skin type and sensitivity during PA. Additionally, prudent use of sunscreen, sun-protective clothing, and appropriate post-exercise skin hygiene is crucial. In summary, PA represents a double-edged sword in relation to skin health; while moderate exercise can enhance skin health, intense exercise or inadequate protective measures may exacerbate skin disorders.

Keywords: physical activity, skin health, dermatology, exercise, lifestyle

Introduction

The skin surface area is often stated to be about 1.8 to 2 m^2, recognized as the largest organ of the human body.[1] The skin comprising epidermis, dermis and subcutaneous adipose tissue, and functions as a critical protective barrier against physical injuries, pathogens and chemicals threats, ultraviolet radiation, and excessive trans-epidermal water loss, while also playing a pivotal role in thermoregulation and sensory perception.[2,3] Skin also contains a high density of extracellular matrix (ECM) that contributes to its tensile strength and flexibility. Skin is not only a simple protective film, but also a visual reflection of the health of the body. Healthy human skin can effectively resist the invasion of commensal and pathogenic bacteria,[4] regulate body temperature,[5] but also has a sensory function to help us perceive the changes in the surrounding environment.[6] But skin function is affected by a variety of factors, including aging,[7,8] disease,[9,10] and lifestyle.[11–13]

Physical activity (PA) as one kind of lifestyle, refers to any bodily movement by the skeletal muscles that requires energy expenditure.[14] The PA interventions was defined as the daily accumulation of at least 30 min of activities as a part of everyday life.[15] It has been well-established that adequate PA, including structured exercise moderate physical activity positively contributes to health, whereas a sedentary lifestyle is detrimental. Similarly, exercise is also an integral part in the treatment and rehabilitation of many medical conditions.[16] PA can influence skin health through various mechanisms. Nevertheless, the effects of PA on skin function have not been extensively studied. Additionally, clinical practice has often neglected to consider both the beneficial and detrimental impacts of exercise on dermatological conditions. This paper aims to thoroughly examine the relationship between PA and skin health, focusing on the alterations in skin induced by PA, the advantages of PA for skin health, the association between PA and skin disorders, and the importance

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of sun protection during physical activity. This discussion seeks to enhance dermatologists' understanding of the interplay between exercise and skin conditions, ultimately guiding patient treatment strategies.

Materials and Methods

We conducted a literature search to identify articles published in English-language journals from January 1980 to May 2025 and did not restrict reporting based on quality of publications. We searched PubMed and Cochrane Library database and using the search terms of "physical activity" or "exercise" or "sport" or "sports" and "skin" or "skin disease" or "epidermis" or "dermis" or "Subcutaneous tissue" or "hair follicle" or "hair" or "sweat gland" or "sebaceous gland" or "keratin" or "dermatology".

The Role of PA on Skin Health

PA and Oxidative Stress

Oxidative stress is characterized by an imbalance between the production of oxidants, including free radicals, reactive oxygen species (ROS), reactive nitrogen species (RNS), and reactive metabolites, and the antioxidant defense mechanisms within cellular systems.[17,18] The generation of ROS and RNS in mammalian cells occurs through multiple pathways. In summary, the superoxide anion (O_2^-) is predominantly produced in mitochondria, where electron leakage occurs from the respiratory electron transport chain.[19,20] Additional endogenous sources of ROS and RNS include cytochrome P450 metabolism,[21] xanthine oxidase activity, peroxisomes, and the activation of inflammatory cells such as neutrophils, macrophages, and eosinophils. Exogenous sources of ROS encompass various physicochemical factors, including exposure to ultraviolet (UV) radiation,[22] electromagnetic fields, γ-rays,[23] X-rays,[24] and persistent environmental chemicals[25,26] such as xenobiotics, organochlorines, and aromatic amines. The relationship between PA and oxidative stress is complex, it is well-documented that ROS production is elevated during exhaustive or prolonged physical activity,[27–29] but regular moderate training appears beneficial for oxidative stress and health.[30–35]

Exposure of the skin to UV radiation and environmental factors, including chemicals such as xenobiotics, constitutes a significant source of ROS. The specific type of ROS generated is contingent upon the energy of the UV radiation. Ultraviolet A (UVA) radiation primarily induces the formation of singlet oxygen ($^1O_2$) through photosensitized reactions. This process occurs in the presence of endogenous chromophores, such as flavins and porphyrins, which are derived from the bacterial flora residing on the skin.[36] Another critical pathway for ROS production in the skin involves the conversion of arachidonic acid to prostaglandin E2 (PGH2), a reaction catalyzed by cyclooxygenase (COX), a prostaglandin-endoperoxide synthase. This enzyme facilitates the synthesis of hydroxyl endoperoxides, subsequently leading to ROS production.[37] Oxidative stress is closely linked to a variety of skin diseases,[38–42] and have already been welly reviewed.

The inadequate PA can cause skin damage. When doing outdoor exercise, solar radiation serves as the primary source of extrinsic skin damage, affecting DNA, proteins, and lipids either directly through the production of photoproducts or indirectly via the formation of ROS.[43,44] Consequently, the skin has evolved several constitutive and inducible protective mechanisms against oxidative damage. These mechanisms include the epidermal synthesis of antioxidant molecules,[45] DNA damage repair,[46] and the production of enzymes that utilize glutathione (GSH) for recycling.[47] GSH plays a crucial role in the skin's response to ultraviolet (UV) radiation by directly interacting with UV-induced reactive species, such as singlet oxygen, hydroxyl radicals, and UV-generated (lipid) aldehydes.[48,49] Therefore, it is essential to replenish the GSH pool through NADPH following UV exposure. Moreover, engaging in physical activity that is either excessively intense or irregular can provoke inflammatory responses at the cellular level and result in damage to muscles or other tissues. Consequently, such activity may be regarded as a potential trigger for skin diseases.[50–52] This phenomenon is attributed to the heightened oxygen consumption, which increases by 10 to 20 times compared to resting levels, leading to the excessive formation of ROS.[36]

In contrast, the mechanism by which regular moderate-intensity physical activity mitigates oxidative stress in the body is primarily manifested in two aspects. Firstly, the principal pathway through which physical activity exerts its preventive effects involves the enhanced production of antioxidants, such as superoxide dismutase (SOD) and glutathione, as well as an increased cellular resistance to reactions driven by free radicals.[53,54] Secondly, low concentrations of reactive oxygen species (ROS) can induce the expression of antioxidant enzymes and other anti-inflammatory agents.[55]

PA and Skin Blood Circulation

Engagement in physical exercise markedly enhances blood circulation, as evidenced by prior studies.[56,57] During exercise, the heart functions as an efficient pump, significantly increasing the frequency of its contractions. In a resting state, the heart rate of a typical adult ranges from 60 to 100 beats per minute.[58] However, during moderate-intensity running, the heart rate can elevate to between 130 and 150 beats per minute or even higher.[59]

During physical activity, the heightened metabolic demands of contracting muscles trigger vasodilation and increase blood flow within the active muscle tissues.[60] Concurrently, body temperature rises, leading to an increase in skin blood flow (SkBF) to facilitate the transfer of metabolic heat from the core to the skin. This convective heat transfer is particularly crucial during dynamic exercise.[61] Research indicates that boys exhibit greater vasodilation and more rapid increases in SkBF during exercise compared to adult men.[62] However, the capacity to regulate SkBF diminishes with primary aging, rendering older adults less capable of effectively thermoregulating and repairing cutaneous wounds.[63] Physical activity has been demonstrated to enhance cutaneous blood flow. Empirical evidence suggests that skin blood flow may double following exercise, with acute maximal exercise elevating the total spectrum power density of cutaneous blood perfusion by approximately 8 fold.[64,65] Engaging in a regular exercise regimen not only augments cutaneous blood flow during physical activity but also enhances cutaneous vasodilatory function. Given that skin hydration is facilitated by a moisture gradient between the deeper dermal layers and the skin surface, sustaining adequate skin blood flow is a crucial factor in maintaining skin hydration.[66] This improved perfusion contributes to a more radiant and healthy complexion. Furthermore, studies have shown that elderly individuals who engage in regular exercise exhibit superior endothelial vasomotor function in cutaneous circulation compared to their sedentary peers. Their skin microvascular endothelial function is comparable to that of younger adults who regularly participate in leisure activities.[60,67]

PA and Skin Cell Metabolism and Aging

PA plays a key role in enhancing skin metabolism. Crane et al,[68] demonstrated that endurance exercise mitigates age-related changes in the skin of both humans and mice, identifying exercise-induced interleukin-15 (IL-15) as a novel regulator of mitochondrial function in aging skin. Exercise modulates IL-15 expression partially through the activation of skeletal muscle AMP-activated protein kinase (AMPK), a central regulator of metabolism. The absence of muscle AMPK results in the deterioration of skin structure. Furthermore, daily IL-15 therapy replicates certain anti-aging effects of exercise on muscle and skin in mice. Therefore, low-dose IL-15 therapy may represent a promising strategy for attenuating skin aging.

The acceleration of metabolism exerts a direct influence on skin cells. Within the epidermal layer, basal cells exhibit a pronounced capacity for division and the generation of new cells.[69] Studies have indicated that when older adults engage in biweekly exercise sessions over a 12-week period, the stratum corneum, which typically thickens with age, becomes thinner.[68] In middle-aged women, a 30-minute daily or alternate-day facial exercise program sustained over 20-week has led to cosmetic enhancements in facial appearance (significant improvement both in upper and lower cheek fullness), suggesting that alterations in skin structure can also result in aesthetic improvements.[70] But the association and mechanism between PA and facial appearance needs further research.

PA and Endocrine and Stress Regulation

Physical exercise plays a significant role in regulating hormone levels and maintaining the balance of the endocrine system. Focusing on common endocrine issues among women, estrogen is a vital sex hormone essential for sustaining women's physiological health and skin condition, as it is involved in the production of cutaneous collagen.[71] Under conditions of high daily stress, women may experience hormonal fluctuations characterized by relatively lower levels of estradiol, free estradiol, and luteinizing hormone, alongside elevated levels of follicle-stimulating hormone.[72] This hormonal imbalance can result in rough skin, a slowed metabolic rate, and a dull complexion.[73] Appropriate physical exercise, such as jogging, jumping rope or running, can promote the body's secretion of neurotransmitters such as endorphins and dopamine,[74–79] which can not only bring a sense of pleasure and relieve stress,[80] but also regulate the endocrine system, so that the levels of estrogen and progesterone to restore balance. Furthermore, long-term mental stress puts the body in a state of stress and increases the secretion of adrenocorticotropic hormone.[81] Excessive secretion of this hormone suppresses the function of the immune system, leading to a decrease in the skin's resistance, which can easily lead to a variety of skin inflammations, such as pigmentation.[81]

PA and Skin Moisturizing Function

The skin performs critical functions, including moisture retention, which regulates the release of water from the body to the external environment, and the barrier function, which prevents the entry of chemicals and microbes from the surroundings into the body.[82] Skin moisturization is acknowledged as the primary anti-aging skincare strategy. It is vital for maintaining the skin's appearance, protection, complexion, softness, and for enhancing its barrier properties against harmful and external environmental factors.[83] There is a strong interrelation between miniaturization and barrier function.[84] Trans-Epidermal Water Loss (TEWL) and stratum corneum (SC) hydration are valuable metrics for assessing the skin's moisturizing and barrier functions.[85]

Research indicates that SC hydration experiences a temporary increase immediately following a single session of high-intensity exercise, but significantly declines after 120 minutes to levels below the pre-exercise state.[86] This reduction in SC hydration post-exercise is attributed to sweating, which causes the stratum corneum to swell and subsequently enhances the outflow of hydro-soluble natural moisturizing factors. However, the impact of SC expansion on hydration is transient.[86] Conversely, engaging in long-term endurance exercise, as opposed to sporadic single sessions, leads to improvements in skin structure, including increased thickness of the stratum corneum.[87] A cross-sectional study conducted in Japan demonstrated that increased physical activity is significantly associated with higher SC hydration levels, indicating that greater activity correlates with enhanced skin hydration. No significant differences were observed in TEWL. These findings suggest that regular exercise may enhance the skin's moisturizing function.[88]

Declines in skin functions, such as moisturizing and barrier capabilities, are believed to be influenced by pronounced deletions in mitochondrial DNA.[89] Endurance exercise has been shown to induce interleukin-5 (IL-5), which promotes mitochondrial biosynthesis, thereby potentially improving skin structure. The enhanced skin hydration observed in physically active individuals may be attributed to improved skin structure resulting from increased mitochondrial biosynthesis.[68] Furthermore, previous research has indicated that sleep efficiency may also impact skin moisturizing function,[13] with exercise potentially contributing to improved sleep quality.[90,91]

PA and Skin Immunity

PA also regulates the inflammatory response and maintains the skin's immune balance. This is because that weight reduction decreases the amounts of adipose tissue, and therefore could reduce inflammation.[92] In addition, weight reduction may lead to increased exercise tolerance,[93] and a positive psychological impact.[94] Psychological stress has been proved to play a role in skin diseases by dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, sympathetic-adrenal-medullary axis, peripheral nervous system, and immune system.[95,96] Stress mediators, such as cortisol, adrenocorticotropic hormone (ACTH), and corticotropin-releasing hormone (CRH), resulting from the activation of the HPA axis, elicit a range of immune responses in the skin. Notably, skin cells are capable of secreting these hormones and actively contribute to skin inflammation. Consequently, the local skin CRH-proopiomelanocortin (POMC)-ACTH-corticosteroid axis is integral to stress-induced responses. Furthermore, keratinocytes and fibroblasts synthesize hypothalamic and pituitary signaling peptides and express corresponding receptors, such as CRH receptors and melanocortin receptors for POMC degradation peptides. This enables these cells to respond to CRH by activating the POMC gene, leading to the secretion of ACTH and subsequently corticosteroids. Additionally, keratinocytes express receptors for various neurotransmitters (eg, adrenaline, noradrenaline, dopamine, histamine, acetylcholine), neurotrophins, and neuropeptides (eg, substance P, nerve growth factor), which are crucial for integrating psychoneuroimmunological mechanisms.[97] This locally expressed, complex stress-induced network has been confirmed to be active in various dermatological conditions, including psoriasis vulgaris, atopic dermatitis, chronic urticaria, human papillomavirus infections (warts), alopecia, and acne.[97–99]

PA and Skin Diseases

Psoriasis

Moderate exercise regulates the immune system and keeps the inflammatory response in a balanced state. For individuals affected by dermatological conditions such as psoriasis, engaging in moderate to vigorous physical activity may enhance skin immunity and serve as an independent preventative measure in mitigating the risk of psoriasis.[100] However, for patients with psoriasis, aerobic exercises are generally better tolerated compared to high-impact sports, which can result in skin trauma and exacerbate plaque formation.[101,102] Activities such as running or CrossFit may subject psoriasis patients to repetitive trauma, potentially leading to the Koebner phenomenon in cutaneous psoriatic lesions, especially when these lesions are located on the knees or other areas frequently subjected to mechanical stress, or even to an aggravation of psoriatic arthropathy. The beneficial effects of exercise on psoriasis may be partially attributed to the reduction of adipose tissue, which secretes pro-inflammatory adipokines, including leptin and resistin, as well as pro-inflammatory cytokines such as TNF-α and IL-6.[100] Consequently, the impact of physical exercise on psoriasis is often associated with weight loss, a well-documented factor in the amelioration of psoriasis severity.[103,104]

Atopic Dermatitis (AD)

PA have both advantageous and adverse effects on AD. On one hand, exercise has been shown to enhance mood and alleviate stress,[105] which are recognized triggers of AD.[106,107] Research by Son et al indicates that moderate to intense aerobic exercise can decrease serum levels of immunoglobulin E (IgE), monocyte chemotactic protein-1 (MCP-1), and macrophage-derived chemokine (MDC), thereby ameliorating the symptoms of atopic dermatitis.[108] Conversely, perspiration and friction can irritate the skin and exacerbate symptoms. Sweat contains components such as histamine, antimicrobial peptides, and proteases, which may irritate the skin and induce itching. Furthermore, prolonged exposure to excessive sweat on the skin surface can result in sweat pore blockage, the formation of keratin plugs, and trigger localized inflammation and itching.[109] To optimize skin health in individuals with AD, it is advisable to engage in low-impact exercises and avoid clothing or equipment that may cause skin abrasion. Additionally, promptly cleansing and moisturizing the skin post-exercise can help maintain the skin barrier and prevent flare-ups.[110]

Hidradenitis Suppurativa (HS)

HS, also known as acne inversa, is an inflammatory dermatological condition predominantly affecting intertriginous regions, and is characterized by the presence of chronic, deep-seated nodules, abscesses, fistulae, sinus tracts, and scarring in areas such as the axillae, inguinal region, submammary folds, and perianal area.[111,112] Physical activity may exacerbate HS symptoms due to increased perspiration and friction in these regions.[113] Effective management of HS in the context of exercise necessitates strategic planning. Individuals are advised to engage in low-impact physical activities and to avoid wearing tight-fitting garments that may cause friction on affected skin. Additionally, maintaining dryness in affected areas and utilizing medicated washes can aid in preventing symptom exacerbation.[114,115]

Acne Vulgaris

Acne vulgaris is a prevalent chronic inflammatory dermatological condition, affecting approximately 9.4% of the global population across various age groups.[116] If left untreated or inadequately managed, acne can lead to post-inflammatory hyperpigmentation, characterized by dull-colored patches on the skin, and may also result in the formation of acne scars.[117] While genetic predisposition is a significant factor in the etiology of acne, lifestyle elements such as diet and physical activity are also contributory.[118] The pathogenesis of acne involves the release of inflammatory mediators, disruptions in keratinization, increased sebum production, and colonization by Cutibacterium acnes (formerly known as Propionibacterium acnes). Furthermore, immune-mediated inflammatory responses, along with factors such as vitamin D and insulin-like growth factor 1, play crucial roles in its development. Cutibacterium acnes is known to stimulate lipid production and induce inflammatory responses.[119]

The role of exercise in acne management has been a subject of considerable debate. The perspiration and increased sebum production associated with physical activity may contribute to pore occlusion and the exacerbation of acne symptoms.[120]

Research indicates a direct correlation between heightened sebum production and the severity and prevalence of acne lesions.[121] Additionally, friction from exercise equipment or clothing can irritate the skin, potentially worsening acne, particularly in individuals with sensitive skin or a predisposition to inflammatory acne lesions.[122] However, a single-blind, randomized pilot study reported no statistically significant differences in truncal acne among groups that did not exercise, showered within one-hour post-exercise, or delayed showering for at least four hours after exercising.[123]

Ultraviolet (UV) Damage

UV radiation encompasses three types: UVA, UVB, and UVC. UVC radiation is entirely absorbed by the ozone layer and rarely reaches the Earth's surface.[124] In contrast, UVA and UVB rays can directly irradiate the skin, leading to potential dermal damage.[125] UVA rays, with wavelengths ranging from 320 to 400 nm, can penetrate the epidermis and reach the dermis, where they damage collagen and elastin fibers.[126] These fibers are crucial for maintaining skin elasticity and firmness; their degradation can result in sagging and the formation of wrinkles. UVB rays, characterized by wavelengths between 290 and 320 nm, primarily affect the epidermis and can cause sunburn, manifesting as redness, swelling, pain, and skin peeling.[127] Chronic exposure to UVB radiation can induce DNA damage in skin cells, thereby increasing the risk of photodamage, solar elastosis, photocarcinogenesis, actinic keratoses, and epitheliomas.[128–130] Furthermore, UVB exposure stimulates melanocytes to produce additional melanin, leading to hyperpigmentation and the formation of pigmented lesions, which can adversely affect the skin's aesthetic appearance.[131]

Preventive Measures to Maintain Skin Health During Physical Activity

Sunscreen

In order to protect skin from the harmful effects of UV rays, adequate sun protection measures should be token before engaging in outdoor sports. Applying sunscreen is the most common method of sun protection, and it is important to choose a sunscreen with an appropriate sun protection factor (SPF) according to the intensity and duration of different outdoor activities. There is abundant evidence suggesting that higher SPF is indeed more effective at sun protection.[132–134] And the SPF value decreases with inadequate application. It is suggested that a high-SPF sunscreen, such as at least 30 or even higher, is preferred to compensate for the typical insufficient application of sunscreen.[135]

Protective Clothing

Protective clothing constitutes another crucial element of sun protection strategies. Garments such as long-sleeved shirts, trousers, and wide-brimmed hats are effective in substantially reducing UV exposure and safeguarding sensitive skin regions, including the face, neck, and hands.

In selecting protective apparel, it is advisable for individuals to prioritize tightly woven fabrics, which provide enhanced UV protection. Certain clothing lines are specifically engineered with UV-blocking properties, thereby offering an additional layer of safety. UV-protective clothing presents distinct advantages over conventional garments, as it is characterized by clearly defined Ultraviolet Protection Factor (UPF) ratings that ensure superior and consistent UV shielding performance.[135] Furthermore, darker colors are more effective in absorbing UV radiation compared to lighter hues, thus selecting darker shades can augment protection. It is also recommended that individuals wear sunglasses to shield their eyes and the surrounding skin from UV damage. The use of a wide-brimmed hat and UVB protective sunglasses, in conjunction with avoiding direct sunlight during peak UVB radiation hours, is regarded as an effective strategy for the primary prevention of cortical cataracts.[136]

Monitoring Skin Type and Sensitivity

Skin type and sensitivity exhibit considerable variation among individuals, affecting their vulnerability to sun-induced damage. Human skin comprises various chromophores, including nucleic acids, urocanic acid, aromatic amino acids, melanin and their precursors, which serve as protective agents against UV radiation stress.[137] Children or individuals with fair skin, light-colored hair, and light eyes are more susceptible to sunburn and skin cancer, whereas those with darker skin may possess higher levels of melanin, which provides some protection against UV rays;[138,139] however, they remain at risk

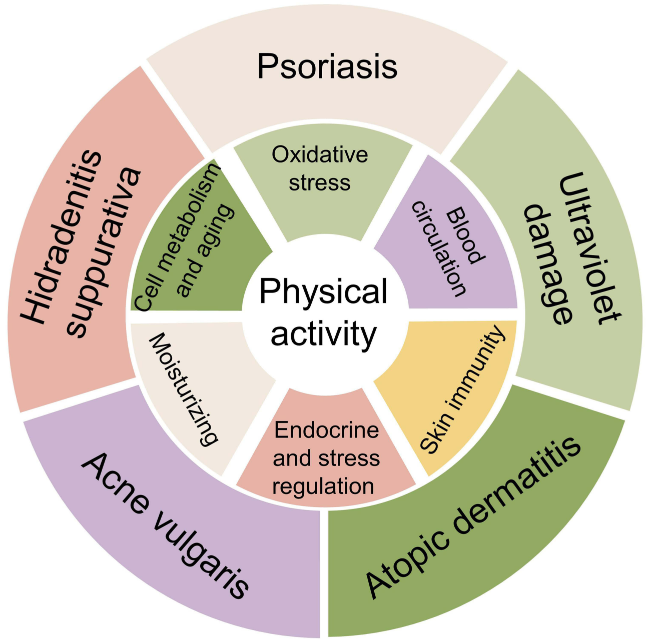

Figure 1 The relationship between PA and skin health and skin diseases.

for skin damage. The basal layer of darker skin, particularly in individuals of Black ethnicity, contains elevated melanin levels, conferring enhanced sun protection relative to Asian or Caucasian skin. The presence of abundant eumelanin in darker skin offers superior defense against UV-induced damage.[140,141] An understanding of one's skin type and sensitivity is essential for the development of personalized sun protection strategies. Individuals are advised to monitor their skin's response to sun exposure and adjust their protective measures accordingly. For instance, fair-skinned individuals may require the application of sunscreen with a higher SPF and the wearing of more protective clothing, while individuals with darker skin should still prioritize the use of sunscreen and seek shade during peak sun exposure times.[142]

Skin Hygiene

Sweating and friction can lead to skin irritation, inflammation, and infection. Prompt cleaning with a gentle cleanser can help remove sweat, dirt, and bacteria, reducing the risk of skin diseases. Cleansing products should preferably have a weakly acidic pH (5.5–6.5) to maintain the skin's natural acidic mantle physiology. Low-pH cleansers (eg, synthetic surfactant-based formulations) can significantly enhance the skin's inherent antimicrobial barrier function.[143] Alkaline cleansers (pH>7) may disrupt the cutaneous acid microclimate, increasing pathogenic bacterial colonization risks and compromising barrier integrity.[144,145]

Conclusions

PA is an essential component of holistic health. However, its effects on skin health are complex and multifaceted. Regular PA can improve circulation and skin metabolism, strengthen the immune system, enhance moisturizing functions, reduce stress, and inhibit oxidative stress. Conversely, inadequate PA may lead to skin irritation and inflammation, and exacerbate conditions such as acne, hidradenitis suppurativa, psoriasis, and atopic dermatitis. Additionally, inadequate preventive measures during PA can result in excessive UV exposure, causing skin damage. Figure 1 illustrates the relationship between PA, skin health, and skin diseases.

Perspectives

A thorough comprehension of the interplay between physical activity and skin health is crucial for the optimization of exercise regimens and the maintenance of dermatological well-being. By choosing appropriate clothing and equipment and consulting with dermatological experts, individuals can reduce the adverse dermatological effects of exercise while maximizing its broad health benefits. Additionally, progress in dermatological treatments and technologies may offer more effective strategies for managing skin conditions in the context of physical exercise. Nonetheless, there is presently a lack of robust clinical and epidemiological evidences concerning the relationship between varying intensities of physical activity and skin diseases, highlighting a critical area for future scientific investigation.

Abbreviations

PA, Physical activity; ROS, reactive oxygen species; RNS, reactive nitrogen species; O2, superoxide anion; UV, ultraviolet; 1O2, singlet oxygen; PGH2, prostaglandin E2; COX, cyclooxygenase; GSH, glutathione; SOD, superoxide dismutase; SkBF, skin blood flow; AMPK, AMP-activated protein kinase; IL-15, interleukin-15; MCP-1, monocyte chemotactic protein-1; MDC, macrophage-derived chemokine; SPF, sun protection factor; UPF, ultraviolet protection factor; TEWL, trans-epidermal water loss; SC, stratum corneum; HPA, hypothalamic-pituitary-adrenal; ACTH, adrenocorticotropic hormone; CRH, corticotropin-releasing hormone; POMC, proopiomelanocortin; AD, Atopic dermatitis; HS, hidradenitis suppurativa; UV, Ultraviolet.

Data Sharing Statement

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests in this work.

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