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# The most common dermatoses of athletes

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## ABSTRACT

### Introduction and purpose

The skin and subcutaneous tissue constitute the body's protective barrier. It also fulfills important physiological functions. It protects internal organs against the harmful effects of environmental factors and maintains the balance between the human body and the environment.

Athlete's dermatoses are a wide group of skin diseases that may occur as a result of specific conditions to which people who practise sports are exposed. Some skin diseases are characteristic of specific sports, while others may occur regardless of the type of physical activity performed. Mechanical damage to the epidermis, excessive humidity, contact with pathogens and exposure to various environmental factors play a key role in the development of these diseases. Regular dermatological check-ups are crucial for identifying and treating skin lesions and preventing mass infections caused by infectious agents. The study discusses the most common dermatoses in athletes, including fungal, bacterial and viral infections, contact dermatitis and dermatoses caused by mechanical and environmental factors.

### Materials and methods

The literature included in the PubMed, BioMed Central and Polish Medical Platform databases is searched by means of the words such as dermatosis, sport, skin, fungal, bacterial, viral infection, contact dermatitis. Quoted sources in selected works were also used.

### Conclusions

Many factors can have a harmful effect on the skin, negatively affect its function as an integral barrier of the body and, consequently, cause the development of dermatoses, which are quite common among athletes due to frequent contact with sweat, clothing, sports equipment and the environments in which they train. Prevention is an important element in minimizing the risk of skin problems and this is key to maintaining health and continuing physical activity.

**Keywords:** dermatosis, sports, fungal infection, contact dermatitis

# Introduction

## 1.1 Skin structure

The skin and subcutaneous layer create the body's covering. The skin consists of three layers - the epidermis (epidermis), dermis (dermis) and subcutaneous tissue (hypodermis), which have different morphogenetic origins (the epidermis comes from the ectoderm, while the dermis and subcutaneous tissue come from the mesoderm) and functions [1]. The epidermis is composed of keratinocytes and has four or five layers - stratum corneum, stratum granulosum, stratum spinosum and stratum basale [2]. The thickness of the skin varies depending on the location - the thickest skin is on the back, the thinnest on the eyelids. The skin is deprived of hair on the palms and soles, and the epidermis is highly keratinized due to the light stratum of epidermis present in these places, which is located between the granular and keratinized layers [1, 3]. There are melanocytes in the epidermis, they produce melanin, which is the skin pigment. Differences in skin color depend on the productive activity of melanocytes and the amount of melanin produced. There are two varieties of melanin. Light melanin is present in the lower phototypes and dark melanin, which determines the brown or black color. When activated by UV rays, melanin may have a carcinogenic effect due to the formation of pyrimidine dimers and cause DNA mutations. Photoprotection through the use of protective clothing and sunblock (at least SPF 30) helps avoid skin burns, skin cancer, melanoma and skin photoaging. Skin burns are characterized by the presence of erythema, which is a "warning signal" of excessive UV radiation exposure and the release of pro-inflammatory cytokines (IL-1, IL-6, TNF-α), which lead to lesions in the epidermis and dermis [4].

In 1975, American dermatologist Thomas Fitzpatrick developed a classification of human skin color in response to the ease of tanning and the risk of possible sunburn. There are six skin phototypes. Phototype I is characterized by a tendency to sunburn and never tans. People with this phototype have light skin, blue eyes, freckles and very light or red hair. Phototype VI is the darkest and applies to black people whose skin is constantly highly pigmented and never burns. There are intermediate phototypes between, with characteristics analogous to those mentioned above according to their reaction to UV radiation [5].

Albinism is caused by a congenital lack or deficiency of melanin (the number of melanocytes in the skin is normal) and is associated with hypersensitivity to radiation and the highest risk of skin cancer. The disease also causes visual disorders such as nystagmus, photophobia and

abnormalities in the central fovea of the retina and optic nerve [6].

The epidermis connects to the dermis through the basement membrane. In the case of skin cancer or melanoma, it is a "barrier" between these structures. The development of the disease in the epidermis is limited (*in situ*), however, after crossing the basement membrane, it becomes generalized and may cause distant or local metastases [2,7].

The dermis is made of fibrous connective tissue and there are blood vessels, nerve endings, numerous receptors, and skin appendages. Skin appendages include hair, nails, sweat glands and sebaceous glands. The dermis is divided into the papillary layer, which is located under the epidermis, and the reticular layer, reaching into the subcutaneous tissue [1,2]. The main building component of the dermis is collagen, which, together with elastic fibers, provides the skin with elasticity and resistance to injuries. The skin is composed primarily of type I collagen (about 80%) and type III collagen (about 20%), and to a lesser extent type V and VI collagen. With age, collagen fibers are lost (about 1% per year) and the skin's firmness and smoothness decreases. The fibers produced are of lower quality, they become shorter and weaker, and this process is mainly influenced by environmental factors (pollution, UV radiation, smoking, alcohol, lack of sleep) [8]. The system of collagen fibers contains plexuses of blood vessels, lymphatic vessels and nerve endings, and the degradation of the fibers leads to the exaggeration of excessively dilated vessels. Due to these unfavorable processes, more and more people decide to take collagen supplements, because it can reduce inflammation and stimulate the synthesis of this protein in the body. Moreover, collagen has a positive effect on the condition of hair and nails, increases the density of bone mass and muscle mass, and supports regeneration after orthopedic procedures because it is found in tendons and ligaments [8, 9].

In the dermis, apart from free nerve endings responsible for pain sensation, there are also Meiskolbkasner's corpuscle, bulboid corpuscle responsible for cold sensation, bulbous corpuscle responding to high temperature, and lamellated corpuscle, which allow the touch and pressure perception [3].

Under the skin there is subcutaneous tissue, which consists of adipocytes and connective tissue that separates groups of fat cells. The bands of connective tissue contain fibroblasts, blood vessels and lymphatic vessels. The most important functions of subcutaneous tissue include storage of reserve substances, protection against injuries and thermal insulation. There are also many processes related to the production of adipocytes, their breakdown and hormonal regulation [10, 11].

### 1.2 Skin functions

The skin performs many important functions, ranging from protection against harmful external factors, through the proper maintenance of water and electrolyte balance by the body. It is a buffer between the environment and the human body, allowing for the maintenance of a constant body temperature, which is necessary for the proper functioning of internal organs [12]. Moreover, it participates in the excretion of metabolic products and the synthesis of vitamin D3. The skin contains mechanical, thermal and pain receptors that allow it to receive stimuli from the immediate environment and send them to the central nervous system. The skin produces about 20% of total cholesterol in the body, and the synthesis is independent of the hormonal mechanisms of the body. The lipid barrier makes it possible to resorption lipophilic substances and drugs. Free fatty acids allow you to maintain an acidic pH within the range of 4.7-5.3, thus preventing infections caused by pathogenic flora. The skin microbiome consists of specific bacteria, fungi and viruses that are tolerated by the immune system and constitute a "protective coat" against pathogenic microorganisms that competitively colonize the body's integument. Most often, disorders and changes in the skin microbiome occur during contact sports, which result in the development or worsening of existing skin diseases [2, 3, 12]. The skin is an immunocompetent organ due to the skin lymphoid tissue (SALT), which enables interaction with antigens and the immune response of the body [13]. It occurs through innate (non-specific) or acquired (specific) immunity. Innate immunity is a direct, immediate reaction necessary upon first exposure to a pathogen. Its aim is to quickly neutralize the pathogen, therefore it involves non-antigen-specific mechanisms: chemotaxis by monocytes, macrophages, neutrophils, phagocytosis and complement activation. The acquired immune response involves the recognition of a specific antigen and involves memory and antigen-presenting cells. It intensifies after repeated contact with the pathogen, is triggered faster and guarantees precise recognition of this agent. The innate response stimulates the acquired response, and their consensual role supports the protection of the body

and enables the discovery of the immunopathogenesis of inflammatory and malignant skin diseases [14, 15].

## Etiological factors of skin diseases of athletes

Many factors can have a harmful effect on the skin and have a negative impact on its function as an integral barrier of the body, and consequently cause the development of dermatoses, which are quite common among athletes due to frequent contact with sweat, clothing, sports equipment and the environment in which they train. [16]. The division of skin diseases among athletes according to the causative factor allows us to see the variety of skin problems and facilitate their diagnosis and treatment. Most often, dermatoses are caused by fungal infections, which include diseases such as tinea pedis, tinea inguinalis, tinea cutis glabrae and candidiasis [17]. Another category are bacterial infections, including impetigo, folliculitis and abscesses, furuncle and carbuncle. Athletes practicing contact sports most often struggle with infection or reinfection herpes simplex virus, human papillomavirus, molluscum contagiosum virus [18]. Contact dermatitis may be caused by both an allergic reaction to allergens present in clothing and a reaction to irritating chemicals, sweat or cleaning and disinfection measures [19]. Dermatoses caused by mechanical factors are another group of diseases, including abrasions, mechanical acne, as well as calluses or blisters that arise as a result of repeated pressure and friction. The last category are dermatoses caused by environmental factors, especially in athletes practicing outdoor sports, exposed to ultraviolet radiation and in people subjected to long-term exposure to low temperatures. [20, 21].

## Fungal infections

Dermatoses caused by fungal infections are the most common dermatological infections in professional and amateur athletes. They are probably also the most common reason for skipping training and refraining from physical activity [22].

Tinea pedis, also called "athlete's foot", usually occurs in runners and athletes due to the warm and moist environment in sports shoes, which favors the growth of fungi. Swimmers who use public locker rooms and swimming pools are also at risk of infection. The main etiological agents are dermatophytes *Trichophyton rubrum, Trichophyton mentagrophytes* i

*Epidermophyton floccosum* [23]. Interdigital epidermophytosis is the most common clinical form of mycosis and is characterized by cracks and exfoliation in the spaces between the toes. People with comorbidities such as diabetes, obesity, atherosclerosis and weakened immunity may develop complications in the form of ulcers and exudate. Desquamative (hyperkeratotic) tinea pedis affects the soles and lateral surfaces of the feet and is often associated with onychomycosis. Dyshidrotic dermatophytosis may be asymptomatic for a long time, then there is a sudden appearance of grouped, itchy vesicles, which may coalesce into larger fluid-filled blisters [23, 24]. Patients are treated with imidazole derivatives (clotrimazole, ketoconazole, miconazole, tioconazole, sulconazole, econazole), terbinafine, naftifine, pyridinone derivatives (ciclopirox olamine), while ones with hyperkeratotic tinea pedis get as well as salicylic acid in their treatment. Remember to disinfect shoes and socks, as washing is insufficient. For disinfection, use a 10% formalin solution, which is soaked in cotton wool and placed in shoes for 24 hours. In patients whose local treatment is ineffective or whose nails are affected, systemic therapy should be considered. Untreated athlete's foot may lead also to nail fungus, cellulitis or secondary bacterial infections [25, 26]. Improving hygiene, washing feet more often, using footwear disinfectants and avoiding walking barefoot in public sanitary places are important in preventing fungal infections [26, 27].

Tinea inguinalis is an infection caused by dermatophytes *Epidermophyton floccosum* or *Trichophyton rubrum* (if the patient suffers from athlete's foot). The highest risk of disease occurs in large crowds and in people who practice contact and team sports [28]. Excessive sweating, tight underwear and poor hygiene predispose to infection. The first symptoms are slowly spreading erythematous lesions, accompanied by itching and burning. Lesions occur in the skin of the groin and may also affect the scrotum, thighs and buttocks. Topical treatments are used to treat this disease with azoles, allylamine derivatives and ciclopirox olamine. The disease is often recurrent, therefore systemic therapy should be used, especially to treat a more serious form of the disease [28, 29]. Prevention includes skin hygiene through regular body washing and the selection of underwear and clothing made of natural materials. Special powders are increasingly used to protect the groin skin [26, 29].

Tinea cutis glabrae is an infection of the stratum corneum caused by *Trichophyton rubrum, Trichophyton mentagrophytes* i *Microsporum canis.* Tinea gladiatorum is most common among judo players and wrestlers [30]. Most lesions can be found on the trunk and upper

extremities, which are exposed to close skin-to-skin contact during physical activity. The skin lesions are erythematous and exfoliative in nature, lacking the characteristic ring shape, peripheral lesions are more intense and have less central brightening [29, 31]. Topical antifungal medications (imidazole derivatives and allylamine derivatives) are used for treatment if the disease is limited, while disseminated cases or cases resistant to current therapy require the use of oral drugs [31, 32].
In order to prevent the transmission of the disease and limit existing outbreaks, disinfection of gym mats, washing the body skin immediately after training is recommended. The use of talcum powder is also used to eliminate hidrosis and reduce skin moisture. [32].

## Viral infections

Viral infections are quite common among athletes, mainly due to close physical contact, sharing locker rooms, sports equipment and participation in intense training. The main factors for infection are repeated injuries and local skin damage. Some of these infections may lead to temporary symptoms, exclusions from physical activity and carry the risk of complications, therefore it is crucial to implement effective prevention [22, 33].

Herpes simplex virus HSV-1 skin infection (*herpes gladiatorum*) most often affects people practicing contact sports (wrestling, combat sports) and team sports (basketball, handball). Most lesions are located in the head, neck, upper limbs and trunk. Initially, burning or itching is felt at the site of subsequent skin lesions [32, 33]. Small vesicles appear on the erythematous base, filled with serous content, then purulent content, and then burst and crusts form. The infection may also be accompanied by systemic symptoms such as fever, lymphadenopathy and general weakness [16, 31]. Approximately 30% of HSV-1 infected people have relapses of the disease caused by stress, UV radiation, immunosuppression or trauma [32].

Herpetic keratitis is a complication of HSV-1 infection, which leads to corneal damage and even complete loss of vision. Other complications include ciliary blepharitis, scleritis, or uveitis [31, 32].

In general treatment, antiviral drugs are used (acyclovir, valacyclovir, famciclovir), while antiviral and antibacterial medications are recommended for topical use [33, 34]. Before competitions, most wrestling federations require regular skin checks to identify viral

or fungal lesions, and some of them recommend valacyclovir to wrestlers as a preventive measure. Sick athletes should be isolated to prevent an epidemic focus [31, 34].

Molluscum contagiosum virus belongs to the *Poxviridae* family and causes molluscum contagiosum skin infection. Swimmers are most often exposed to this disease, and a connection between the development of molluscum contagiosum and the use of swimming pools and saunas. Infection also occurs during direct contact among people practicing contact sports [35]. The lesion is a hard lump, pearly, pink or skin-colored with a characteristic central umbilicus-shaped vallecula [31, 35].

The treatment of molluscum contagiosum is curettage, but electrocoagulation, cryosurgery or laser therapy may also be used. Topically, imiquimod, 5% potassium hydroxide, tretinoin, less often podophyllotoxin, cantharidin, trichloroacetic acid, lactic acid, salicylic acid, 5-fluorouracil can be used. In lesions that are extremely resistant to treatment, intralesional therapy interferon-α is used. Untreated lesions may persist for 6-9 months [31, 35, 36]. Athletes should be instructed to self-examine and report skin lesions, as early detection and treatment will minimize the time taken out of training and prevent the spread of infection [33, 35].

Viral warts are the result of the human papillomavirus (HPV) infection, which is transmitted through direct skin contact or sharing hygiene items [31].
There are three main varieties of warts: common warts (*verrucae vulgares*), plantar warts (*verrucae plantares*) and flat warts (*verrucae planae*) [38].
Common warts caused by HPV-2 are hyperkeratotic lumps with a smooth surface and are most often located on the hands (fingers, backs of hands, around the nails). Black spots become visible under the hyperkeratotic layer, which are caused by microthrombosis in the capillaries. They help the doctor distinguish a wart from a corn or callus [31, 38].
Plantar warts caused by HPV-1 (*myrmecia*) is the most common infection among swimmers. Damage to the epidermis caused by staying in a humid environment facilitates the spread of infection. The lesions are endophytic lumps and appear on the soles and lateral surfaces of the toes.
Plantar warts caused by HPV-2 are more superficial and painless, but are difficult to treat due to their large number and frequent recurrences [36, 37].
Flat warts (*verrucae planae*) (HPV-3, HPV-10) are numerous small lumps with a flat surface, arranged in a linear manner with the Köbner phenomenon present. They are most often

located on the backs of the hands and face [36, 38]. Treatment of viral warts includes curettage, electrocoagulation, $CO_2$ laser therapy, cryotherapy and photodynamic therapy, however, these techniques may prevent the athlete from returning to sports immediately. Topical therapy with salicylic acid, lactic acid, imiquimod or cantharidin has a lower risk of side effects and can be used by athletes who cannot miss training. Flat warts should be treated with topical retinoids. Resistant warts may require antigen injection *Candida albicans*, bleomycin, 5-fluorouracil or cidofovir [31, 38]. Infection can be prevented by avoiding the use of shared hygiene products and wearing appropriate protective clothing and footwear in places where there is a risk of the virus [32].

## Bacterial infections

Bacterial skin infections most often affect players practicing contact sports (combat sports, football, basketball), because close physical contact facilitates the transmission of bacteria between participants [22]. Athletes are exposed to injuries, abrasions and intersections, which may constitute portals for bacteria to enter. The weakening of the skin's natural defense mechanisms increases the risk of developing bacterial infections [39]. Bacterial dermatoses can take many forms, from superficial infections such as impetigo to deeper and more painful lesions such as boils and carbuncles. Understanding the characteristics of these infections is essential to prevent their occurrence and minimize their impact on health and sports results [33, 39].

Contagious impetigo is a superficial skin infection caused by *Staphylococcus aureus* the *Streptococcus pyogenes.* Most often, these are infections with mixed bacterial flora. It is characterized by superficial vesiculopustular eruptions that dry into honey-yellow crusts. In the bullous form of impetigo, the blisters are larger, their contents are initially transparent and later become cloudy. *S. aureus* produces epidermolytic exfoliative toxin, which acts on the stratum granulosum of the epidermis and is responsible for the formation of blisters [16, 33]. Treatment includes topical antibiotics (mupirocin, fusidic acid) and disinfectants. In cases of extensive lesions that are resistant to external therapy, antibiotics are used according to the antibiogram (amoxicillin with clavulanic acid, erythromycin, clarithromycin, clindamycin, cephalosporins) [40].

Folliculitis is primarily a staphylococcal infection (S. aureus), although cases caused by Gram-negative bacteria have also been described. Infection caused by *Pseudomonas aeruginosa* appears approximately 48 hours after swimming in heated pools (jacuzzi, hot tubs), long-term exposure and insufficient water disinfection [33, 41]. If the infection affects the hair follicle openings, the lesions are superficial and appear as well-tensed blisters. However, if the infection affects the entire follicle, follicular pustular eruptions may be observed [41].

In the case of deep lesions that reach the perifollicular tissue we are dealing with a furunculus. It is a deep, inflammatory and painful infiltration that breaks through to form a necrotic plug that comes out with purulent secretion. Carbuncle is formed as a result of focusing and several boils merging together. The change is accompanied by local swelling and pain, local lymphadenopathy and fever. The infection is serious because it can lead to severe complications, including sepsis, endocarditis, and osteomyelitis [31, 36]. Most often, the lesions are located on the face, neck and buttocks. Furunculus in the area of the upper lip, eye sockets and temple are dangerous due to the possibility of transmission of the infection to the meninges [36].

Treatment includes the use of disinfectants and antibiotic ointments (mupirocin, fusidic acid). Ichthyol ointment compresses are effective for treating boils. In the case of very extensive lesions and resistant to previous therapy, antibiotics are used according to the antibiogram (penicillins resistant to beta-lactamase, cephalosporins, fluoroquinolones, trimethoprim/sulfamethoxazole). In the case of a carbuncle, surgical incision and drainage remain to be considered [33].

Bacterial diseases occurring among swimmers and people who use water facilities deserve special attention. Factors contributing to these diseases include long-term contact with water, lack of hygiene, and water pollution in swimming pools and other water reservoirs [35].

Swimmer's ear is a bacterial infection of the external ear caused by bacteria *Pseudomonas aeruginosa* the *Staphylococcus aureus*. It has been proven that this disease occurs five times more often among swimmers than in non-swimmers, which explains its name. Symptoms of the disease include ear pain, sometimes accompanied by ear discharge. In more severe cases, the ear canal may swell, which may cause hearing problems [35, 42]. Treatment involves the use of antibiotic ear drops combined with a corticosteroid [42].

Pitted keratolysis (*keratolysis punctata*) is an infection of the plantar surface of the feet caused by *Corynebacterium species* and *Kytococcus sedentarius*. The bacteria cause keratolysis of the stratum corneum and produce substances that cause an unpleasant, rancid odor [16]. The lesions include numerous, small, shallow craterlike pits or erosions on an erythematous base. Factors contributing to infection are excessive sweating of the feet and exposure to excessive humidity [43, 44].

Treatment includes the topical application of antibacterial medications (erythromycin, mupirocin, fusidic acid, clindamycin) or imidazole derivatives. Daily foot hygiene and the preventive use of disinfectants and exfoliants are important [16, 43].

Erythrasma (*erythrasma*) is caused by *Corynebacterium minutissimum* and manifests itself clearly delimited from the surroundings with erythematous spots with slight peeling on the surface. It develops in a warm and moist environment of skin folds, in the intertriginous areas (groin, armpits, inframammary folds, spaces between the fingers, posterior rugae). Treatment is the same as in pitted keratolysis. The course of the disease may be chronic and recurrent [33, 44].

Pool granuloma is caused by atypical bacteria *Mycobacterium marinum* i *Mycobacterium scrofulaceum*. Infection occurs when bacteria present in fresh or salt water enter through damaged skin. Symptoms include small, red bumps or lumps on the skin that may develop into painful ulcers. These lesions most often appear on the hands, fingers or legs and in places that have had direct contact with infected water.
The first-line treatment involves oral antibiotic therapy with clarithromycin or minocycline [16, 35].

## Contact dermatitis

Contact dermatitis can be divided into allergic or non-allergic eczema (dependent on irritating factors) [45]. In the case of allergic contact dermatitis, sensitization occurs upon first exposure to the allergen, and skin symptoms appear only after repeated contact with the allergen. Allergenic factors include rubber (safety glasses, diving mask, caps, fins), neoprene (diving wetsuit), some dyes, and chemicals used for disinfection [45, 46]. Irritant contact eczema

occurs as a result of damage to the epidermis, long-term destruction of the lipid barrier, changes in pH and skin microflora [47].

Differentiating allergic eczema from irritation eczema may be difficult; epidermal tests are decisive. Skin tests at specific concentrations of test substances cause inflammatory reactions only in allergic people [45].

Contact dermatitis is most often located on the back of the hands, but it can occur anywhere there is contact with an allergenic substance. It is characterized by inflammatory changes, small bubbles and exudate. Chronic lesions have poorly defined borders, thickening and wrinkling of the skin. [35, 46].

First, the provoking factor must be eliminated. Topical corticosteroids and oral antihistamines are used to treat contact dermatitis. In case of secondary bacterial infection, topical antibiotics should be used. In rare cases of severe contact dermatitis, systemic glucocorticosteroids are used [35, 47].

## Dermatoses caused by mechanical factors

Dermatoses caused by mechanical factors are skin lesions that result from repeated friction, pressure or other types of mechanical trauma [39].

Blisters, corns and calluses occur in almost every athlete. They appear on the skin most often on the fingers and toes. Each of these lesions is a defensive reaction of the skin to chronic mechanical trauma, and their treatment mainly involves reducing friction and pressure by wearing appropriate footwear, acrylic socks and using creams with urea or vaseline [33].

Acne mechanica manifests as numerous erythematous papules and pustules, most commonly located on the arms, chin, chest or other areas covered with protective clothing (mask, helmet, knee pads) and exposed to pressure and friction. Treatment is similar to other types of acne, using topical antibiotics and keratolytic ointment [33, 48].

Most skin diseases caused by mechanical factors are located on the hands and feet. Hyperpigmentation, thickening and transverse lines of the toenails of athletes who run a lot and make sudden stops have been classified as "tennis toe". Talon noir (“black heel”) is caused by intraepidermal bleeding and is characterized by horizontally arranged dark spots on the upper edges of the heel. These spots should be differentiated from melanoma.

Piezogenic papules are painful fatty hernias, usually located on the posterolateral part of the heel, less often on the wrists and the ball of the thumb. They appear as a result of maintaining a long standing position, but disappear in a horizontal position [33, 36].

| | **Acne mechanica** | **Tennis toe** | **Talon noir** | **Piezogenic papules** |
|---|---|---|---|---|
| **Running** | | | X | X |
| **Football** | X | | X | |
| **Basketball** | X | X | | |
| **Tennis** | | X | X | |
| **Combat sports** | X | | | |

Table 1. Selected dermatoses caused by mechanical factors in athletes [16].

## Dermatoses caused by environmental factors

Dermatoses caused by environmental factors are skin lesions resulting from exposure to various external factors [39].

Dry skin in athletes is most often caused by long-term exposure to environmental factors, such as intense sun exposure, wind, low air humidity and frequent contact with chlorinated

water in swimming pools. These factors lead to disruption of the skin's natural lipid barrier and cause it to become excessively dry. Using emollients once a day, especially before training, can eliminate this condition [22, 36].

Other skin diseases of athletes caused by environmental factors are presented in Table 2.

| **Environmental factor** | **Dermatosis** |
|---|---|
| Low temperature | frostnip |
| | frostbite |
| | cold urticaria |
| UV radiation, long-term exposure to the sun | sunburn |
| | phototoxicity |
| | actinic keratosis |
| | basal cell carcinoma |
| | squamous cell carcinoma |
| | malignant melanoma |

Table 2. Dermatoses in athletes caused by environmental factors [22].

## Conclusions

Athletes are a group particularly exposed to various dermatoses due to specific conditions related to practicing sports, such as intense physical exercise, long-term contact with humid environments, UV radiation, low temperatures and frequent mechanical injuries. Regular use of protective measures such as sunscreens, emollients, appropriate protective clothing, and personal hygiene can significantly reduce the incidence of skin diseases. Athletes' and coaches' education about potential skin damage factors and how to avoid them should be an integral part of preparation for training and competition to minimize the risk of dermatoses.

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**Author's contribution:**

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