



## THE NURSE'S ROLE IN RECOGNIZING DERMATOLOGICAL CHANGES IN INDIVIDUALS WITH DIABETES MELLITUS

MATEA GOLEŠ<sup>1,3</sup>, ĐOMAGOJ MARKOVIĆ<sup>1,3</sup>, VIŠNJA KOKIĆ MALEŠ<sup>2,3</sup>

*Diabetes is a chronic, progressive metabolic disease that has now reached pandemic proportions. It's estimated that 10.5% of the world's population has diabetes, making it a global challenge that requires attention and innovative strategies from healthcare systems worldwide. While macrovascular complications remain the leading cause of death in diabetes patients, this study provides a detailed description of dermatological changes in these individuals, with a particular emphasis on the severity of diabetic foot conditions. Within the realm of dermatological manifestations, specific changes such as acanthosis nigricans, diabetic dermopathy, and xerosis are thoroughly described, and they are all specific for individuals with type 2 diabetes. Other manifestations, such as diabetic blisters and vitiligo, which are more common in individuals with type 1 diabetes, are also analysed. The study places a special focus on the crucial role of nurses in recognizing skin changes in diabetes patients. It highlights the importance of continuous education about precise insulin application and emphasises the need for regular systematic skin examinations, particularly in areas that are not easily visible to the patient, such as the feet or back. Nurse educators, like physicians, also share the responsibility for demonstrating self-examination skills or conducting joint examinations of these areas during consultations. Ultimately, this study advocates for an active partnership between healthcare professionals and individuals with diabetes to collectively address the challenges presented by diabetes, particularly in terms of dermatological changes.*

Keywords: SKIN, DIABETIC FOOT, NURSE, DIABETES MELLITUS

### INTRODUCTION

As diabetes affects the physiology of microvasculature, such as the eyes and kidneys, it can also impact the small blood vessels of the skin, resulting in dermatological changes (1). While there are numerous theories about the pathophysiology of specific skin disorders associated with diabetes, the mechanism by which the disruption of normal insulin and glucose metabolism affects the skin is not yet fully understood (2).

Individuals with type 2 diabetes are more likely to develop skin changes compared to those with type 1 diabetes (3). Skin issues can manifest as the initial symptom of diabetes or arise at any point during the course of the disease. In a clinical analysis encompassing 750 individuals with diabetes, dermatological changes were noted in 594 patients. The most frequently observed issues included skin infections (47.5%), skin dryness (26.4%), and inflammatory skin diseases (20.7%) (4). Nurses play a crucial role in detecting dermatological changes in individuals with diabetes through careful monitoring and clinical assessment.

### DISCUSSION

Dermatological changes in individuals with diabetes can be categorised based on their cause, type, and localization. In addition, there is another important classification of the most common dermatological changes that provides an overview of various skin alterations as-

sociated with diabetes and helps in better understanding their connection to this disease. In this paper, specific changes are presented: diabetic foot, skin manifestations closely associated with diabetes, nonspecific dermatological changes associated with diabetes, dermatological diseases associated with diabetes, skin infections in people with diabetes, and skin changes associated with diabetes medications.

### DIABETIC FOOT

Diabetic foot (Figure 1) refers to the changes that result from the interaction of microvascular and macrovascular complications, frequently resulting in ulcer development (5). The risk of developing a diabetic foot ulcer over a person's lifetime with diabetes ranges between 19% and 34% (6). The risk of mortality over a five-year period is 2.5 times greater for individuals with diabetic foot ulcers compared to those with diabetes but without such ulcers (6). Extensive



Figure 1.  
Diabetic foot (prior to amputation)  
(Source: private archive of the author, with patient's consent)

research consistently highlights diabetic foot complications as the leading cause of non-traumatic lower extremity amputations and a substantial contributor to hospitalisations among diabetic patients (7). This study revealed that amputations in individuals with diabetes constituted a significant share, amounting to 68.6% of all amputations (8). Notably, this percentage has exhibited a consistent upward trend, commencing at 61.1% in 2010 and climbing to 71.4% by 2019 (8).

Neuropathy (autonomic, motor) and ischemia represent two key pathologies in diabetic foot that lead to the characteristic features of ulcerous wounds (neuropathic and ischemic) (9). Individuals with neuropathy experience reduced sensitivity to pain and temperature / heat, meaning that many patients are slower to detect foot injuries (9). Autonomic neuropathy can result in reduced sweating, leading to dry and cracked skin, which facilitates the entry of microorganisms into deeper layers of the skin. Additionally, motor neuropathy can cause foot deformities that result in soft tissue damage due to displaced pressure points (2). Peripheral arterial disease can diminish the blood flow necessary for wound heal-

ing and infection control. Elevated blood glucose levels compromise the function of white blood cells and weaken the defence mechanism. When one or more of these risk factors are present, trauma increases the frequency of subsequent infections and encourages the formation of slow-healing wounds (1). Preventive measures can help prevent the occurrence of diabetic foot:

- Checking for touch sensation in the feet is important because there is a possibility that a person may not be able to feel pain or pressure as a warning sign of injury (10). Nurse educators and physicians are responsible for regularly examining the patients' feet.
- Seeking advice on foot care from a nurse educator and/or a physician. A comprehensive foot examination should be conducted at least once a year (10). During every patient encounter, the nurse should inquire about the symptoms of dermatological changes and independently examine critical areas.
- Performing foot exercises at least once a day (1). Foot exercises can be learned by participating in educational programs conducted by nurse educators.

### SKIN MANIFESTATIONS CLOSELY ASSOCIATED WITH DIABETES

#### Acanthosis nigricans

Acanthosis nigricans is characterised by silky, light brown to black hyperpigmented plaques that appear in skin folds (11). Acanthosis typically presents with a symmetrical distribution and tends to appear at the posterior aspect of the neck, underarms, inner elbows, palms, under the breasts, the navel area, and within the folds of the groin. In cases of extensive involvement, there could be mild discomfort or odour (12).

Acanthosis is more prevalent in individuals with type 2 diabetes and is often seen with greater frequency in those with darker skin tones (11). Additionally, acanthosis may also manifest in various endocrine disorders linked to insulin

resistance, including acromegaly, Cushing's syndrome, obesity, polycystic ovarian syndrome, and thyroid disorders (1). The exact cause of acanthosis is not yet completely understood. The most widely accepted theory suggests that hyperinsulinemia plays a central role in its pathogenesis. It is believed that elevated levels of insulin lead to the activation of insulin-like growth factor (IGF) receptors, particularly IGF-1, on keratinocytes and fibroblasts, thereby stimulating cell proliferation and giving rise to the dermatological features associated with acanthosis (4). Although there is no specific treatment for the lesions, the appearance of the skin can be improved by the application of retinoic and salicylic acids (12).

#### Diabetic dermopathy

Diabetic dermopathy is a common condition that presents as small, pigmented papules on the pretibial area (Figure 2), representing the most common skin manifestation in individuals with diabetes type 2 (13). While it can also



Figure 2.  
Diabetic Dermopathy  
(Source: Private archive of the author, with patient's consent)

occur in healthy individuals and sometimes in people with diabetes type 1, it is present in approximately 40% of people with diabetes type 2 (1). Additionally, men over the age of 50 are more likely to experience dermatopathy (4).

The lesions are often present on both legs, but the distribution can be asymmetric. They can also appear on the forearms, thighs, and lateral side of the ankles (1). Research shows that blood flow values in dermatopathy sites are similar to values at scars (4). It is possible that skin scars observed in dermatopathy result from poor blood circulation associated with diabetes type 2 (4). Blood glucose control is not linked to the occurrence or progression of these issues, and there is no effective treatment for these lesions (11).

#### Diabetic bullae

Diabetic bullae are a clinically recognisable sign of diabetes type 1 that often occurs in adults with long-standing diabetes and peripheral neuropathy (4). However, this condition can also be the first sign of diabetes (2). The pathogenesis of bullae formation is currently not understood (1). The lesions appear spontaneously and are most found on the lower extremities and feet (11). They present as painful, transparent blisters on non-inflamed skin, containing sterile fluid (11, 13). These lesions can vary in size, ranging from a few millimetres to several centimetres (12). Typically, they tend to heal within two to six weeks, but recurrence is common (1). The 'blisters' typically resolve spontaneously without the need for treatment, and the primary objective of management is to prevent secondary infections and related complications, such as necrosis or osteomyelitis (13). This entails safeguarding the affected skin, maintaining the integrity of the blisters (except in the instance of larger blisters, which may be punctured to prevent rupture), and vigilant monitoring for signs of infection (11). The use of topical antibiotics is generally unnecessary unless there are specific indications, such as the presence of a secondary infection or positive culture results (4).

#### NONSPECIFIC DERMATOLOGICAL CHANGES ASSOCIATED WITH DIABETES

##### Xerosis

Xerosis is indeed one of the most prevalent skin conditions in individuals with diabetes, affecting as many as 40% of patients with diabetes, and it is particularly common in those with type 2 diabetes (11). Xerosis refers to extremely dry skin, which can exhibit peeling, cracking, or a rough texture (1). These skin changes often occur on the feet of individuals with type 1 diabetes (11). Reduced skin moisture increases susceptibility to damage, potential infections, or trauma (4). Skin cracks on the hands and fingertips can cause pain or infection in patients who self-monitor their blood glucose levels (11). The use of moisturising creams or oils on the hands helps reduce such cracks (1). It is recommended to gently wash hands with soap and water before measuring blood glucose rather than using alcohol wipes, as alcohol further dries the skin. Patient education by a nurse educator on the importance of skin hygiene is crucial to preventing skin lesions.

##### Xanthoma

Xanthoma often occurs because of hyperlipidaemia, particularly elevated triglycerides associated with diabetes (1). Approximately 75% of individuals diagnosed with diabetes show symptoms and signs of dyslipidaemia (11). Insulin promotes the activity of lipoprotein lipase, which is an important enzyme in the metabolism of lipoproteins containing high levels of triglycerides (3). Insulin insufficiency, as observed in poorly controlled diabetes, decreases the activity of lipoprotein lipase, leading to the buildup of chylomicrons and other lipoproteins rich in triglycerides (3). Eruptive lesions rapidly develop on the extensor surfaces of the arms, legs, and buttocks, starting as red papules and later changing into yellow papules on a red base. The lesions can be individual or clustered in a rosette-like pattern (11). Dietary modifications and pharmacotherapy aimed at normalising the disrupted lipid profile reduce the risk of heart problems and contribute to the treatment of xanthomas (4).

#### DERMATOLOGICAL DISEASES ASSOCIATED WITH DIABETES

##### Vitiligo

Vitiligo (Figure 3) is a relatively common occurrence in individuals with type 1 diabetes, characterised by a lack of melanocytes (13). The prevalence of vitiligo in people with diabetes (both in men and women) ranges from 1% to 7%, while in the general population, it ranges from 0.2% to 1% (1, 4). It is also observed in conditions such as Addison's disease, Hashimoto's thyroiditis, Graves' disease, rheumatoid arthritis, psoriasis, systemic lupus erythematosus, pernicious anaemia, and celiac disease (1). People with vitiligo typically display dispersed and clearly defined areas of depigmentation, which can manifest in different regions of the body. However, these depigmented areas frequently impact the extremities and the facial areas (11). Lymphocytes 'attack' melanocytes, resulting in the appearance of white, chalky-coloured lesions on the skin, often found above extensor joints such as the elbow and finger joints, as well as around the mouth and eyes (3). Regarding the treatment of vitiligo, the emphasis is on reducing T-cell reactions and promoting the return and regeneration of melanocytes (1). The first-line treatment includes systemic psoralen plus ultraviolet A therapy or corticosteroids with ultraviolet B radi-



Figure 3.  
Vitiligo

(Source: Private archive of the author, with patient's permission)

tion (11). Moderate sun exposure can also be beneficial (1). Most individuals with vitiligo continue to notice new vitiligo patches throughout their lives. Although it does not cause symptoms, it can lead to disfigurement, resulting in significant psychosocial stress (12).

#### SKIN INFECTIONS IN PEOPLE WITH DIABETES

Skin infections in individuals with well-managed diabetes tend to have a similar occurrence rate and level of severity as those in the general population (1). However, patients with suboptimal glycemic control often experience more frequent and severe infections that are harder to resolve (4). Approximately 20-50% of individuals with type 2 diabetes develop skin infections (11).

Elevated glucose levels cause a range of immune dysfunctions that make patients more susceptible to infections and slow down the healing process (3). In a state of hyperglycemia, leukocytes have difficulty passing through thickened capillary walls, phagocytic activity is reduced, and chemotaxis is slowed, all of which contribute to worsening infections (1).

Neuropathy and peripheral vascular disease can mask infection symptoms, allowing the infection to progress unchecked (4). The presence of infection further elevates glucose levels, contributing to the cycle of hyperglycemia and prolonging the recovery process (5).

Infections caused by staphylococci and fungi, especially on the lower extremities, more commonly develop in individuals with diabetes and are often resistant to therapy (12). For certain patients, skin infections become chronic, promoting skin degradation and exposing them to a higher risk of more serious secondary infections (13).

#### Bacterial infections

Common infections include erythrasma, impetigo, folliculitis, multiple abscesses, furuncles, and carbuncles (14). Erysipelas and cellulitis often present with a more severe clinical course (4).

Erysipelas and cellulitis are skin infections caused by bacteria that typically affect the superficial layers of the skin, including the dermis (15). Erysipelas is most attributed to *Streptococcus pyogenes* (Group A streptococcus), while cellulitis can be induced by various bacteria, including *Staphylococcus* and different types of *Streptococcus* bacteria (15). Cellulitis can penetrate deeper layers of the skin and subcutaneous tissue (15). Cellulitis typically causes redness, swelling, warmth, and pain in the affected area (11). Unlike erysipelas, the boundaries of cellulitis may be less well-defined, and the infection can spread. Like erysipelas, cellulitis can also lead to systemic symptoms such as fever and chills (15).

#### Fungal infections

Elevated glucose concentrations in saliva and increased skin pH in intertriginous areas in individuals with diabetes could potentially create a favourable environment for the proliferation of *Candida* fungi (12). Candidiasis can affect mucous membranes (e.g., oral candidiasis, vulvovaginal candidiasis), intertriginous areas (such as intertrigo, erosion between the fingers, balanitis), or nails (such as paronychia), causing itching, redness, and white plaques (1).

Recurrent *Candida* infections of the vagina, anogenital area, regions under the breasts, and axillae often occur in individuals with obesity and type 2 diabetes (13). In the study of women with obesity and diabetes/prediabetes, the oral microbiota showed specifically increased levels of *Candida* species (16). In men, the folds of the prepuce and the coronal margin of the penis are prone to balanitis and phimosis (1). Folded areas are challenging to keep clean and dry, providing an ideal warm and moist environment for dermatophyte growth (1). Due to the location of the infection, the application of local antifungal creams can be challenging, often leading to incomplete treatment and the persistence of fungi (14).

The most common dermatophytosis in individuals with diabetes is tinea pedis, also known as athlete's foot, which



Figure 4.  
Onychomycosis

(Source: Private archive of the author, with patient's permission)

presents with itching, redness, flaking, and blistering on the skin of the feet (4, 11). People with diabetes may be more susceptible to developing tinea pedis due to changes in foot sweating and circulation, creating a moist environment conducive to fungal growth (1).

Onychomycosis (Figure 4), a fungal nail infection, can be caused by dermatophytes or *Candida* infection (12). Onychomycosis is characterised by the presence of subungual hyperkeratosis and separation of the nail from the nail bed and occurs in almost half of patients with type 2 diabetes (4). Managing the condition of onychomycosis involves the use of topical or oral antifungal agents (11). In severe cases, surgical treatment may be applied (11).

#### SKIN CHANGES ASSOCIATED WITH DIABETES MEDICATIONS

##### Allergic Reactions to Insulin

True allergic reactions to insulin with a systemic response such as urticaria or anaphylaxis are extremely rare, with delayed hypersensitivity being more common in practice (1). In cases of a true allergy to insulin, desensitisation is the therapy, which is usually carried out under medical supervision (12). Although skin reactions to insulin are rare, they often manifest as raised, warm nodules that form at the injection site and typically appear between 15 minutes and 2 hours after the injection (11). Thanks to

the production of purified and recombinant insulins, the incidence of allergic reactions to insulin has been reduced (12). Since the advent of recombinant insulins, the estimated prevalence of allergic reactions to insulin is less than 1% (12).

### Lipohypertrophy

Lipohypertrophy (Figure 5), a medical condition characterized by irregular accumulation or redistribution of subcutaneous fat, is increasingly drawing attention due to its association with various underlying causes and implications (1). While lipohypertrophy is more common in type 1 diabetes, its prevalence is significantly high in type 2 diabetes as well (12).

In a study conducted in 2022, the prevalence of lipohypertrophy ranged from 30.26% to 72.54% in individuals with diabetes (17). Across ten studies involving a combined cohort of 4,392 adult individuals living with both type 1 and type 2 diabetes, the collective prevalence of lipohypertrophy stood at 51.73% (17).

Individuals who use intermediate or long-acting insulins are more likely to experience lipohypertrophy compared to those using short-acting insulins (12). This is because long-acting insulins



Figure 5.  
Lipohypertrophy

(Source private archive of the author, with the patient's permission)

remain at the injection site for a longer duration, allowing for the accumulation of fat and proteins (12). Lipohypertrophy most commonly results from frequent subcutaneous injections (11). Repeated needle insertions in the same area disrupt the normal balance of fat and distribution in the region where injections are administered (11). This disrupted distribution can lead to the formation of clusters of fatty tissue beneath the skin (1).

Lipohypertrophy is not associated with physical pain. Typically, patients can still administer injections in the affected area because the sensation of an insulin injection is diminished (1). However, continuous use of areas with lipohypertrophy can reduce insulin absorption and potentially disrupt glucose control (12). The number of possible injection sites on the body is limited, and lipohypertrophy further reduces this option, making it essential to care for this condition properly (17).

Healing of lipohypertrophic skin can take several months, and sometimes even years. Since insulin absorption in lipo-hypertrophic skin is unpredictable and can lead to hypoglycemia in individuals with diabetes, it is crucial to avoid insulin administration in the affected area.

### Prevention of lipohypertrophy

Nurse educators play a crucial role in educating individuals with diabetes and their families or carers on the following aspects:

- **Correct Injection Technique:** Enable the person to perform the insulin injection technique correctly (review the injection technique, demonstrate it, and then practice with the person to achieve the correct technique).
- **Preventing Needle Reuse:** Educate on the importance of using a new needle for each insulin injection to prevent complications. This practice helps maintain needle sharpness, reduce discomfort during injection, lower the risk of infections, and ensure precise and efficient insulin delivery.

Additionally, it is essential to instruct patients to always keep the needle protected with a cap when not in use to maintain needle cleanliness and sterility, ensuring safety and hygiene throughout the insulin administration process.

- **Needle Length and Site Rotation:** Provide information about the advantages of using shorter needles for easier site rotation and reduced risk of intramuscular injections. Educate on the correct site rotation principles:
  - Avoid using the same area for more than four weeks.
  - Divide larger areas (such as the buttocks or thighs) into halves or quadrants for more efficient rotation.
  - Use a logical sequence for site rotation, for example, use each abdominal quadrant for one week before moving to the next.
  - Maintain a minimum distance of at least 1 cm (about the width of a finger) between each injection site.

### Dermatological reactions caused by oral anti-hyperglycemic agents

Among the various oral agents currently used in the treatment of diabetes, those with the highest likelihood of causing dermatological side effects are associated with sulfonylurea derivatives (12). The sulfa component of the drug can trigger an allergic reaction that often results in an uncomfortable rash with characteristics resembling measles (11). First-generation sulfonylurea derivatives, such as tolbutamide and chlorpropamide, which are rarely used, are often linked to such side effects (12).

In some cases, even second-generation sulfonylurea derivatives like glimepiride and glibenclamide can cause urticaria, photosensitivity, redness, and itching. These symptoms usually subside after discontinuing the medication (1). Sensitivity to sulfonylureas may indicate that the patient is likely to react to other sulfonylureas (11). It's also important to

note that dipeptidyl peptidase-4 inhibitors can lead to skin side effects (18). Rare but severe side effects include inflamed blisters on the skin that form bubbles, such as bullous pemphigoid, and serious reactions like the rare but severe skin condition known as Stevens-Johnson syndrome.

Other oral drugs commonly used for treating diabetes typically do not show an association with dermatological side effects (1). Metformin, a biguanide, is rarely associated with skin conditions similar to psoriasis, erythema multiforme, leukocytoclastic vasculitis, photosensitivity, urticaria, and exanthema (1). Skin manifestations of SGLT-2 inhibitors like balanitis, vaginitis, and very rare penile cellulitis, at risk of progressing to Fournier's gangrene.

### RECOGNISING AND TREATING DERMATOLOGICAL CHANGES IN INDIVIDUALS WITH DIABETES

Dermatological disorders often manifest in individuals with diabetes but are frequently overlooked or insufficiently recognised (11). The overall prevalence of dermatological disorders in type 1 and type 2 diabetes varies between 51.1% and 97% in different regions worldwide (19). More than a third of patients (63.5%) display skin manifestations associated with type 2 diabetes (20). In another study, 38% of patients had skin lesions considered related to type 1 diabetes (21). The nurse plays a crucial role in detecting dermatological changes in individuals with diabetes through careful monitoring and clinical assessment:

- **Regular skin monitoring**
- **Inquiring About Symptoms:** By asking precise questions to patients, the nurse can identify symptoms such as itching, rashes, redness, swelling, or any changes in skin texture.
- **Education:** The nurse can educate individuals about the importance of self-skin examination.
- **Collaboration with Dermatologists**
- **Database and Tracking**

- **Continuous Education:** Nurses should regularly stay updated on new information and guidelines.

### Insulin injection education

Nurse educators assess and monitor local allergic reactions at insulin injection sites. Regularly assessing injection sites helps identify and track any allergic reactions. If reactions persist, nurse educators must consider the possibility of switching the person to an alternative type of insulin and inform the physician about the patient's condition.

Another key role is to educate patients about potential systemic allergic reactions to insulin and the correct response in these situations. Education of this nature ensures safe and efficient insulin administration, minimises the risk of complications, and promotes optimal diabetes management.

### CONCLUSION

Highlighting the importance of education on preventive skin care for individuals with diabetes represents an invaluable aspect of healthcare. Education focuses on improving hygiene, early recognition, and appropriate response to any suspicious skin conditions, with the crucial involvement and expertise of diabetes nurse educators.

Skin manifestations closely associated with diabetes, such as diabetic bullae, lack prescribed treatment protocols. Numerous studies on different treatment modalities require consistent daily attention, which can be a substantial burden for patients. In cases such as xanthomas and insulin injection site lipohypertrophy, the focus should be on addressing the root cause. Continuous monitoring and proper care play a pivotal role in achieving positive outcomes.

Furthermore, diabetes nurses should monitor possible medication-related side effects and intervene if they occur. Interdisciplinary collaboration among healthcare professionals, including diabetes nurses and physicians, is essential for providing comprehensive care.

Diabetes nurse educators play a crucial role in encouraging patients to regularly examine areas prone to complications, such as diabetic foot ulcers. Besides providing education, they also have the responsibility and skills to perform self-examinations or joint examinations of these areas during consultations to recognise the need for further intervention promptly.

It is essential to emphasise that care for patients with diabetes-related dermatological issues does not end after initiating treatment. On the contrary, continuous attention and monitoring are critical for achieving optimal results and preventing potential complications. It is essential to keep nurse educators informed about the latest knowledge and practices in dermatological care for individuals with diabetes.

### DISCLOSURE

The authors declare that they have no relevant or material financial interests that relate to the research described in this paper. All data in this paper are presented in bachelor's thesis "The nurse's role in recognizing dermatological changes in individuals with diabetes" written at the University Department of Health Studies, University of Split (22).

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Autori su popunili the *Unified Competing Interest form* na [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (dostupno na zahtjev) obrazac i izjavljuju: nemaju potporu niti jedne organizacije za objavljeni rad; nemaju finansijsku potporu niti jedne organizacije koja bi mogla imati interes za objavu ovog rada u posljednje 3 godine; nemaju drugih veza ili aktivnosti koje bi mogle utjecati na objavljeni rad./ All authors have completed the *Unified Competing Interest form* at [www.icmje.org/coi\\_disclosure.pdf](http://www.icmje.org/coi_disclosure.pdf) (available on request from the corresponding author) and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

## LITERATURE

- Childs BP. Complete Nurse's Guide to Diabetes Care. 2009.
- Holt Ma R, Bchir, Flyvbjerg A, Goldstein B. Textbook of Diabetes edited by fourth edition (Internet) Available from: <https://www.blackwellpublishing.com/content/textbookofdiabetes/downloads/chapters/allchapters.pdf>.
- Kleinberger JW, Pollin TI. Personalized medicine in diabetes mellitus: current opportunities and future prospects. *Ann N Y Acad Sci.* 2015 Jun; 1346 (1): 45-56. doi: 10.1111/nyas.12757. Epub 2015 Apr 23. PMID: 25907167; PMCID: PMC4480162.
- Rosen J, Yosipovitch G. Skin Manifestations of Diabetes Mellitus (Internet). Feingold KR, Anawalt B, Boyce A, Chrousos G, Dungan K, Grossman A, et al., editors. *PubMed. South Dartmouth (MA): MDText.com, Inc.; 2022.* Available from: <https://www.ncbi.nlm.nih.gov/books/NBK481900/>.
- Vrhovac B, Jakšić B, Reiner Ž, Vucelić B. *Interna medicina.* 4. dopunjeno izdanje, Zagreb: Ljevak; 2008.
- Edmonds M, Manu C, Vas P. The current burden of diabetic foot disease. *J Clin Orthop Trauma.* 2021 Feb 8; 17: 88-93. doi: 10.1016/j.jcot.2021.01.017. PMID: 33680841; PMCID: PMC7919962. Trieb K. The Charcot foot. *Bone Joint J.* 2016 Sep 1; 98-B (9): 1155-9. <https://doi.org/10.1302/0301-620X.98B9.37038>.
- Walicka M, Raczynska M, Marcinkowska K, Lisicka I, Czaicki A, Wierzbna W, Franek E. Amputations of Lower Limb in Subjects with Diabetes Mellitus: Reasons and 30-Day Mortality. *J Diabetes Res.* 2021 Jul 24; 2021: 8866126. doi: 10.1155/2021/8866126. PMID: 34350296; PMCID: PMC8328738.
- Poznyak A, Grechko AV, Poggio P, Myasoedova VA, Alfieri V, Orekhov AN. The Diabetes Mellitus-Atherosclerosis Connection: The Role of Lipid and Glucose Metabolism and Chronic Inflammation. *Int J Mol Sci.* 2020 Mar 6; 21 (5): 1835. doi: 10.3390/ijms21051835. PMID: 32155866; PMCID: PMC7084712.
- Meloni M, Izzo V, Giurato L, Lázaro-Martínez JL, Uccioli L. Prevalence, Clinical Aspects and Outcomes in a Large Cohort of Persons with Diabetic Foot Disease: Comparison between Neuropathic and Ischemic Ulcers. *J Clin Med.* 2020 Jun 8; 9 (6): 1780. doi: 10.3390/jcm9061780. PMID: 32521700; PMCID: PMC7356179.
- American Diabetes Association. Standards of Medical Care in Diabetes-2019 Abridged for Primary Care Providers. *Clin Diabetes.* 2019 Jan; 37 (1): 11-34. doi: 10.2337/cd18-0105. PMID: 30705493; PMCID: PMC6336119.
- Rosen J, Yosipovitch G. Skin Manifestations of Diabetes Mellitus (Internet). Feingold KR, Anawalt B, Boyce A, Chrousos G, Dungan K, Grossman A, et al., editors. *PubMed. South Dartmouth (MA): MDText.com, Inc.; 2022.* Available from: <https://www.ncbi.nlm.nih.gov/books/NBK481900/>.
- Van Hattem S, Bootsma Ah, Thio Hb. Skin manifestations of diabetes. *Cleveland Clinic Journal of Medicine.* 2008 Nov 1; 75 (11): 772-87.
- Mendes AL, Miot HA, Haddad Junior V. Diabetes mellitus and the skin. *Anais Brasileiros de Dermatologia (Internet).* 2017; 92 (1): 8-20. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5312172/>.
- Gkogkolou P, Böhm M. Skin disorders in diabetes mellitus. *JDDG: Journal der Deutschen Dermatologischen Gesellschaft.* 2014 Sep 27; 12 (10): 847-64.
- Brishkoska-Boshkovski V, Kondova-Topuzovska I, Damevska K, Petrov A. Comorbidities as Risk Factors for Acute and Recurrent Erysipelas. *Open Access Maced J Med Sci.* 2019 Mar 15; 7 (6): 937-42. doi: 10.3889/oamjms.2019.214. PMID: 30976336; PMCID: PMC6454161.
- Hudek Turković A, Matovinović M, Žuna K, Škara L, Kazazić S, Bačun-Družina V, Durgo K. Association of Vitamins D, B9 and B12 with Obesity-Related Diseases and Oral Microbiota Composition in Obese Women in Croatia. *Food Technology and Biotechnology,* 2022; 60 (2): 135-44.
- Peng S, Xu M, Zhao H, Yang H, Zhang L, Hu S, Liu H, She Y, Lee M, Li H. Gender Differences in Prevalence and Clinical Correlates of Lipohypertrophy in Insulin-Exposed Patients with Diabetes Mellitus. *Diabetes Metab Syndr Obes.* 2022 Dec 14; 15: 3871-87. doi: 10.2147/DMSO.S392324. PMID: 36540349; PMCID: PMC9760066.
- Röhrborn D, Wronkowitz N, Eckel J. DPP4 in Diabetes. *Front Immunol.* 2015 Jul 27; 6: 386. doi: 10.3389/fimmu.2015.00386. PMID: 26284071; PMCID: PMC4515598.
- de Macedo, G.M.C., Nunes, S., Barreto, T. Skin disorders in diabetes mellitus: an epidemiology and physiopathology review. *Diabetol Metab Syndr* 8, 63 (2016). <https://doi.org/10.1186/s13098-016-0176-y>.
- Rasid S, Muthupalaniappen L, Jamil A. Prevalence and factors associated with cutaneous manifestations of type 2 diabetes mellitus. *Clinical Diabetology.* 2020 Dec 30; 9 (6): 461-8.
- Miloš D, Pavlović, Tatjana Milenković, Miroslav Dinić, Milan Mišević, Dragana Daković, Slađana Todorović, Zorana Đaković, Radoš D. Zečević, Radoje Doder; The Prevalence of Cutaneous Manifestations in Young Patients With Type 1 Diabetes. *Diabetes Care* 1 August 2007.
- Goleš M. Uloga medicinske sestre u prepoznavanju dermatoloških promjena u osoba sa šećernom bolesti (Završni rad). Split: Sveučilište u Splitu, Sveučilišni odjel zdravstvenih studija; 2023. <https://urn.nsk.hr/urn:nbn:hr:176:765112>.

## Sažetak

## ULOGA MEDICINSKE SESTRE U PREPOZNAVANJU DERMATOLOŠKIH PROMJENA U OSOBA SA ŠEĆERNOM BOLESTI

Matea Goleš, Domagoj Marković, Višnja Kokić Maleš

Šećerna bolest je kronična, metabolička, progresivna bolest koja je poprimila pandemijske razmjere. Smatra se da 10,5% svjetskog stanovništva boluje od šećerne bolesti, što predstavlja globalni izazov koji zahtijeva pozornost i kreativne strategije zdravstvenih sustava. Iako su makrovaskularne komplikacije i dalje prvi uzrok smrti u bolesnika sa šećernom bolešću, u radu su detaljno opisane dermatološke promjene u bolesnika sa šećernom bolešću, s posebnim naglaskom na ozbiljnost dijabetičkog stopala. Unutar sfere dermatoloških manifestacija detaljno su opisane specifične promjene kao što su acanthosis nigricans, dijabetička dermopatija i kseroza koje su karakteristične za osobe sa šećernom bolesti tipa 2. Analizirane su i druge manifestacije kao što su dijabetičke bule i vitiligo, koje se češće javljaju u osoba sa šećernom bolesti tipa 1. Poseban fokus je usmjeren prema bitnoj ulozi medicinske sestre u prepoznavanju promjena na koži u osoba sa šećernom bolešću. U tu svrhu, rad ističe važnost kontinuiranog obrazovanja bolesnika o preciznoj primjeni inzulina, dok istovremeno naglašava potrebu za redovitim sistematskim pregledima kože, osobito onih dijelova tijela koja nisu lako vidljiva bolesniku, poput stopala ili leđa. Medicinske sestre edukatori, osim što pružaju obrazovanje, poput liječnika preuzimaju odgovornost i demonstriraju vještine samopregleda ili zajedničkog pregleda manje vidljivih područja tijela tijekom konzultacija. Rad naglašava važnost interdisciplinarnog pristupa, aktivnog partnerstva između zdravstvenih djelatnika i osoba sa šećernom bolesti kako bi se promjene na vrijeme uočile, a ukoliko su već nastupile da se redovito prate kako bi se spriječio ili umanjio razvoj dermatoloških promjena.

Ključne riječi: KOŽA, DIJABETIČKO STOPALO, MEDICINSKA SESTRA, ŠEĆERNA BOLEST

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