

Original Article

# The Use of Dalmatian Tansy And Auxiliary Substances As Natural Substitutes In The Treatment of Dermatoses

Igielska - Kalwat Joanna<sup>1,2</sup>, Kilian - Pięta Ewa<sup>1</sup>

<sup>1</sup>Dermatology Center Laboratory Symbiosis, Rubież 46 H, Poznan, Poland

<sup>2</sup>University of Education and Therapy, Grabowa 22, Poznan, Poland

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**Abstract** - The study conducted research aimed at confirming the effectiveness of the active ingredients contained in the Pyretrin-D series affecting the improvement of biological parameters of the skin. The products are natural substitutes used in the treatment of skin diseases, mainly demodicosis. The paper describes the effectiveness of Dalmatian pyrethrum daisy and the excipients. To confirm the efficacy of the tested formulations, MPA 580 Courage + Khazaka electronic GmbH probe system and the POLDERMA EXPLORE 3D device were used. Measurements included: skin hydration, transepidermal water loss (TEWL), oil level, and pH value. The research was carried out on a group of 30 probands.

**Keywords** — Demodicosis, Dalmatian pyrethrum daisy, cosmetic formulations, skin biophysical parameters, Demodex

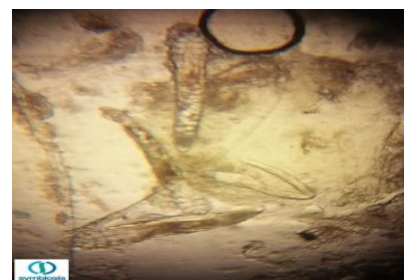
## I. INTRODUCTION

Demodex are arachnids of the mite order. Their main food is epidermal cells and components of sebum. They inhabit facial skin, especially the areas rich in sebaceous glands, such as the nose, cheeks, forehead, and chin. Less commonly, they may occur in the external auditory canal or on the skin of the chest.

Demodex mites avoid sunlight at all stages of their development. They only leave the inside of the hair follicles at night to travel along the surface of the skin at a speed of about 16 mm/h in search of a reproductive partner. The life cycle of Demodex consists of five developmental stages and lasts approximately 14-18 days. Two species of Demodex can live on human skin. They are of a worm-like shape, and their bodies are covered with a thin cuticle [1].

Demodex folliculorum reaches the size of 0.3-0.4 mm in length, has an elongated shape, and occurs at the orifices of hair follicles, often forming clusters. The second type, Demodex brevis is smaller, reaches 0.2-0.3 mm in

length, has a spindle shape, and has shorter legs. Most often, it lives alone. It occurs deep inside the sebaceous gland on the skin of the face or in the meibomian gland within the eyelids. Demodex brevis feeds on glandular cells, causing their destruction. Due to the deep location, it is difficult to extract without breaking tissue continuity (Fig. 1). Because of this, its influence on the human body and the role in the pathogenesis of skin diseases is less well known [2].



**Fig. 1 Structure of Demodex folliculorum and Demodex brevis.**

(Source: own study - Symbiosis Dermatology Center)

Both species of Demodex differ in the intensity of occurrence on human skin. *Demodex folliculorum* is more numerous, but *Demodex brevis* often covers a larger area of the body. The proportion in the incidence is also different when comparing *Demodex brevis* to *Demodex folliculorum*. Namely, in men, it is 1: 4, and in women 1: 10 [3].

The clinical symptoms they cause are also different: *Demodex folliculorum* causes mainly erythema and exfoliation of the epidermis, while *Demodex brevis* is the cause of the appearance of symmetrically located papular, pustular eruptions. The changes are probably caused by the toxic and allergenic effects of metabolites of these mites, such as guanine and proteases (serine and cysteine). These metabolites

are also the main causes of allergic and contact dermatitis in house dust mite allergy sufferers [4]. The presence of



Demodex mites has been found in representatives of all human races, but their mere presence does not determine the development of the demodicosis disease. They are transferred from person to person during direct contact, through the use of shared toiletries, towels, and also through the dust. Demodicosis is an umbrella term for a group of chronic inflammatory dermatoses of the skin, leading to the weakening of the skin-epidermal barrier, caused by the toxic and allergenic effect of metabolites of mites living in humans, such as *Demodex folliculorum* and *brevis* [5]. Characteristic symptoms of demodicosis are alternating exacerbations and remissions of inflammations, probably related to the Demodex development cycle, manifesting disorders typical of rosacea, seborrheic dermatitis, dry eye syndrome, and various forms of dandruff typically located on the face, the scalp, and in the eye area. The etiopathogenesis of demodicosis is complex and not fully confirmed. The inflammatory changes that accompany demodicosis can be compared to the mechanism of atopic dermatitis (AD) caused by contact with house dust mite faeces [6]. Erythema, skin sensitivity to factors such as temperature changes, cosmetics intolerance, flaking, dryness, itching, and eczema are typical symptoms of the dysfunction of the epidermal-lipid barrier.

## II. EXPERIMENTAL SECTION

### MATERIALS AND METHODS

#### A. The performance of the procedure and the conditions for using the Pyretrin-D series

In the initial phase of the research, cosmetics from the Pyretrin-D series were prepared with the aim of effective elimination of problems related to a Demodex infection. They are recommended for sensitive skin and for people struggling with erythema and rosacea. Incidentally, the use of active antimicrobial substances has become part of the desired trends regarding skin and hair care during the coronavirus pandemic. The formulations have been created in such a way as not to cause intolerance to the raw materials they contain. The series included the following products:

Micellar foam with dalmatian tansy, which is intended for washing and cleansing the face, eyes, and eyelashes. A special light foam formula is designed to be applied to the skin in combination with running water. It is recommended as a washing method during antibiotic therapy and treatment with antiparasitic preparations and exfoliating products.

Then the probands applied a face tonic with almond acid, dalmatian tansy, tea tree oil, and geranium oil which aims to restore the proper pH value of the skin.

In the next stage, the volunteers applied the Pyretrin-D normalizing serum. The last stage of the home skincare routine was the application of a normalizing and moisturizing cream, the main ingredients of which are Dalmatian tansy extract and black cumin oil. All products have been developed and tested at Laboratorium Centrum Dermatologic Symbiosis Sp. z o.o.

#### B. Conditions of use of cosmetics

- The probands applied the cosmetics twice a day, in the morning and in the evening (at similar times) at the site of the onset of dermatosis (face). The method and sequence of application were presented by the researcher.
- When using cosmetic formulations, **it was forbidden** to use other care products in the test area.
- The tested preparations had to be used regularly over the period of 6 weeks.
- Use of the products should have been discontinued immediately in the event of any irritation or allergy symptoms.
- Unexpected side effects had to be reported to the person conducting the trial.
- The following properties of the preparations had to be observed: impact, tolerance, feeling on the skin, hydration, smoothing, spreadability, and absorption capacity.
- Participation in the study was voluntary. It was possible to withdraw from the study at any stage of its duration without giving any reason. Personal data was processed only for the purposes of scientific analysis in accordance with the law in force in Poland (*Act of 10 May 2018 on Personal Data Protection, Journal of Laws 2018, item 1000*).
- The research was conducted following the approval of the Bioethics Committee, resolution number 640/20.

At the Symbiosis Dermatology Center, an application study was conducted (*in vivo*) on the skin of volunteers, confirming the effectiveness of the applied Pyretrin-D series. The tests were also carried out in real conditions. A group of 30 people underwent a Pyretrin-D treatment. The treatment was the first step in the preparation of the experiment. Home care routine, on the other hand, was the second stage aimed at eliminating skin problems faced by the patients. The participants of the study underwent a Pyretrin-D treatment at the Symbiosis Dermatology Center. This therapeutic cosmetological procedure supporting the treatment of demodicosis (infection with Demodex) was developed by specialists from Centrum Dermatologic Symbiosis Sp. z o.o.

It consists in cleansing the skin by exfoliation with a specially developed chemical peeling with extracts of tansy, tea tree oil, geranium, and rosewood. The procedure is carried out in such a way that it is possible to combine the in-office treatment with dermatological and ophthalmic treatment (ocular Demodex infection) without irritation.

The main purpose of the treatment is to empty the skin pores by non-invasive cleansing and chemical damage to adult mites. Immediately after the treatment, the skin is fresh and not irritated, but on the following day, slight reddening may appear.

Another goal of the procedure is to cleanse the skin of metabolites and allergens that are toxic to the skin, resulting from the aforementioned infection with Demodex. The mites contaminate the area of the sebaceous glands, causing erythema, burning, and discomfort. The peeling is a cosmetic product that additionally has a proven antibacterial effect against *Propionibacterium acnes* and *Staphylococcus aureus*. It also supports dermatological procedures in the treatment of rosacea caused by Demodex infection. The treatment is also recommended for people with sensitive skin and seborrhea.

### **C. Description of the Pyretrin-D treatment:**

#### ***Pyretrin-D peel 50% Back To Comfort treatment for the face, back, and neckline (pH 2.9)***

#### **The course of the procedure:**

##### **a) Preparation for peeling:**

Wash your face thoroughly (with Pyretrin-D foam and water) and dry thoroughly with a towel.

##### **b) Cavitation peeling:**

Apply 0.5-1 ml of Pyretrin-D tonic to a cotton pad, then moisten it with lukewarm water. Perform cavitation peeling. Pat the skin dry with cosmetic pads.

##### **c) Performing Pyretrin-D 50% Peeling:**

Apply about 0.5 - 1 ml of peeling to a cotton pad. Then apply on the skin, evenly spreading, avoiding the eyelids, without rubbing. Use your fingertips to pat the product until the acid crystallizes completely on the skin. Then wash off with pads or a towel with plenty of cold or lukewarm water without rubbing the skin. Repeat the washing process until the burning sensation is completely gone, especially in the T zone.

##### **d) Application of Pyretrin-D/Sod-C serum:**

Apply a few drops of the serum and massage into the skin of the face until completely absorbed. The purpose of applying the serum is to feel the skin-soothing. The serum is indispensable after chemical peeling as it reduces the oxidative stress of valuable lipids in the epidermis. Gently massage the remains of the product in.

##### **e) Applying the Pyretrin-D cream mask:**

After previously applied products, massage one dose of the mask into the skin of the face and eyelids until absorbed.

##### **f) Applying a hydrogel mask:**

Apply the mask on the skin of the face. Leave the product for 15-20 minutes.

##### **g) Drug application (optional):**

Follow the instructions of a dermatologist and cosmetologist from the Symbiosis Dermatology Center Sp. z o.o. The drug may be recommended only after medical consultation and verification of the indications for its use.

##### **h) Application of the Pyretrin-D cream:**

In the last stage of the treatment, gently wash off the excess of the previously used products with a pad and water. Massage in the moisturizing cream. Optionally, apply a cream with a minimum filter of 30+SPF [7].

The procedure was performed on the first day and after 6 weeks of the study.

### **D. Apparatus tests using the POLDERMA EXPLORE 3D device**

The POLDERMA EXPLORE 3D device used in the research is a multidimensional 3D skin analyzer. Polderma Explore 3D is a device designed for a comprehensive analysis of the skin of the face. Thanks to this technology, specialists in the field of chemistry, cosmetology, and aesthetic medicine can develop more personalized treatment programs and control their results. Advanced 3D technology enables an enlarged visualization of any surface of the facial skin, thanks to which a detailed assessment of the analyzed area is possible.

The device uses three lighting systems that allow one to obtain a comprehensive image of the skin, as well as special software for the intelligent analyzer, which is designed to compare two images - before and after a cosmetic procedure. Visible RGB light, responsible for detecting discoloration, unevenness, pores, and wrinkles. UV radiation with a wavelength of 365 nm, responsible for the detection of UV discoloration and porphyrins. PL polarized light, responsible for highlighting red areas and brown discoloration. The analysis covers 8 skin changes, including discoloration, wrinkles, skin structure, pores, UV discoloration, brown discoloration, red areas, and porphyrins.

### **E. Study of the measurement of biophysical parameters of skin**

The study of the measurement of biophysical parameters was carried out using a set of probes MPA 580 Courage + Khazaka electronic GmbH connected to a computer and equipped with a probe for measuring temperature and air humidity. All measurements were carried out on 20 probands in the T-zone (cheeks, chin, and forehead), i.e., the places where cosmetics were applied. The tests were performed before the start of the treatment and home care routine (trial zero) and then after 2, 4, and 6 weeks of the experiment.

Hydration measurements were conducted using a corneometer which indicates the hydration level of the superficial layers of the skin (stratum corneum). Measurement is based on electrical conductivity. The higher the water content in the epidermis, the lower the capacitive resistance, which indicates a higher degree of skin hydration.

Measurement of transepidermal water loss was carried out on the skin of all probands. Transepidermal Water Loss (TEWL) tests were performed using a Tewameter from the MPA 580 Courage + Khazaka electronic GmbH probe assembly. The device has sensors that measure humidity and temperature, and thus it is possible to determine the duration of the proper level of skin hydration (water evaporation rate).

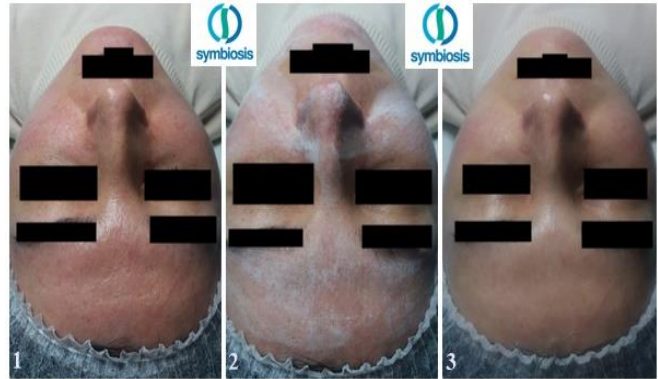
Measuring the level of skin lubrication using oily spot photometry. Sebometer is used to determine the level of fat content by means of a plastic film whose light transmission changes after moistening the surface with fat. This test illustrates the functioning of the sebaceous glands of the skin.

Measurement of the pH value of the skins was examined using a pH meter. It is based on a non-invasive method in which a device consisting of an electrode in a glass probe is applied to the surface of the skin. The results are given on a pH scale that defines the concentration of hydrogen ions. The skin reaction depends on factors related to the epidermis and glandular secretion. The pH of the epidermis surface is a key test informing about the skin's susceptibility to infection or being prone to keratosis disorders and seborrhea because the acidic pH of 5.3-5.5 maintains the natural skin microflora. Contrastively, alkaline pH increases the growth and penetration of harmful microorganisms, causing infections. The pH rate also contributes to the resistance of sensitive skin, the reactivity of which depends on its changes during care activities such as washing, applying creams, or toning. The allergic reaction to cosmetics is often confused with the reactivity to changes in the pH of the epidermis during the application of individual products. It may be possible to properly select the pH of those products after analyzing the epidermis.

### III. RESULTS AND DISCUSSION

#### A. The performance of the procedure and the conditions for using the Pyretrin-D series

Figure 2 shows the effect of the treatment obtained in one of the participants of the experiment in order to reduce the erythema. After a thorough examination, demodicosis was diagnosed in the patient. The procedure described in the experimental part was proposed.



**Fig. 2 1) Photo of the proband's skin before the procedure. 2) Photo of the skin during the treatment. 3) Photo of the skin after the entire Pyretrin-D treatment (Source: own study - Symbiosis Dermatology Center)**

Erythema present on the skin of the face and visible telangiectasias are very often misdiagnosed as skin with a tendency for breaking capillaries. It turned out that the probands with erythema symptoms suffered from infection with *Demodex folliculorum* or *brevis* [8], which was diagnosed using a laboratory test consisting in collecting scraped epidermis and/or eyelashes/eyebrows/scalp hair and squeezing the sebum content out of the sebaceous gland. The collected material is placed on a glass slide. A few drops of a physiological saline solution or a 20% KOH solution are added, covered with a coverslip, and viewed under a light microscope.

Toxic and allergenic effects of metabolites of this parasite, like the faeces of other mites with a similar composition, generate an immune response in the skin by the release of pro-inflammatory cytokines, which, once the acute phase ends, show neovascularization [9].

This process is influenced by vascular endothelial growth factor (VEGF), produced as a response of tissues to increased oxygen demand in the process of skin regeneration. In the case of chronic demodicosis, the pathological process of angiogenesis may be initiated, resulting from exacerbations and remissions of inflammation. It can be observed in the form of stellate hemangiomas and telangiectasia. In the process of creating a new capillary which is often mistaken for rupture, cathelicidin (a protein antibacterial agent) plays an important role. The main ingredient of the treatment is mandelic acid which has an anti-comedogenic effect, dissolving the sebum and clearing the clogged outlets of the hair follicles from the residual sebaceous masses. During cosmetic cleansing, the base material helps to empty the content of the sebaceous gland, thus reducing irritation and the risk of exacerbation of infection. It also minimizes secondary bacterial infections to which the facial skin is exposed in the conditions of a weakened lipid barrier. Its keratolytic effect prevents the colonization and spread of *Demodex* mites on the surface of the skin and in the sebaceous glands.

In order to prove the diagnosis, an apparatus examination was performed with the use of the POLDERMA EXPLORE 3D device.

**B. Apparatus tests using the POLDERMA EXPLORE 3D device**

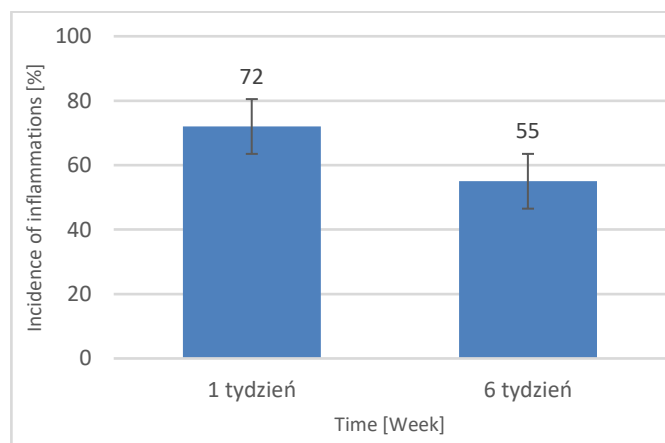
Photos of a patient qualified for the Pyretrin-D series and procedures are presented below. Concentrated red zones (Red Zone) are associated with excessively occurring changes such as telangiectasia, erythema, and inflammatory changes caused by rosacea and infection by *Demodex folliculorum* or *brevis*.



**Fig. 3 Summary of the results of the probands in the first and sixth weeks of the study using the Polderma Explore device (Source: own work - Symbiosis Dermatology Center)**

In the above-mentioned sample, after 6 weeks of routine, which included professional and home treatment, a total decrease in the possibility of inflammation caused by *Demodex folliculorum* or *brevis* infection was observed. Confirmed the antibacterial effect of the products and treatments has helped the patients.

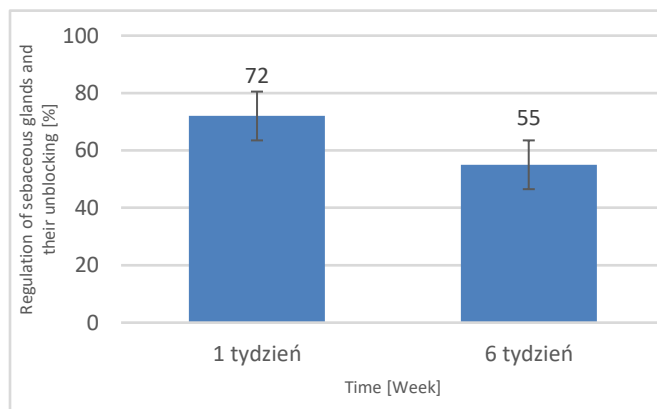
The graph below shows the average decrease in inflammatory lesions for all probands (Figure 4).



**Fig. 4 Average result of the probes showing the incidence of inflammation in the first and sixth weeks of the study (n=30), \* - p <0.05**

As can be seen in the chart, after 6 weeks of experiments, a decrease in the inflammatory lesions of on average 34.5% was observed. This proves that the symptoms faced by the patients were largely eliminated. The appropriately selected formula of the Pyretrin-D series proves the improvement of the patients' skin condition. The complexion, colloquially called "capillary," is undoubtedly a complex of symptoms resulting from the disturbance of the hydrolipid barrier, improper care, diseases, intensification of demodicosis, and the full effects of rosacea in adulthood [10].

Another very important application of the Pyretrin-D series is the regulation of the work of the sebaceous glands and unblocking the pores. Pores - round and open, located on the surface of the skin. They are the openings of the sebaceous and sweat glands through which sebum and sweat are secreted. Thanks to the use of Dalmatian tansy, geranium, and tea tree oils containing a high concentration of 4-terpineol, regulation of the work of the sebaceous glands and unblocking of the pores has been noticed. The chart below shows the average decrease in the tested dysfunction after 6 weeks of research.



**Fig. 5 Average test result showing the parameter responsible for the regulation of sebaceous glands and their unblocking in the first and sixth week of the study (n=30), \* - p <0.05**

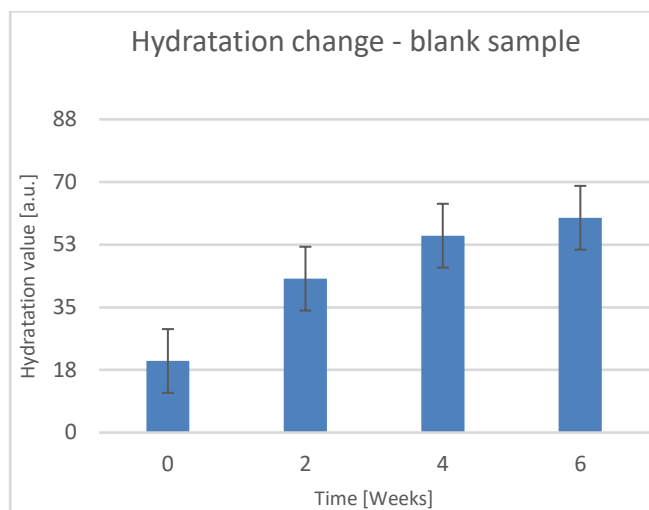
The closure of the pores constituting the openings of the sebaceous and sweat glands through which sebum and sweat are secreted in an average manner after 6 weeks of research was 35%. The results were also confirmed in the study of skin biophysical parameters.

**C. Study of the measurement of biophysical parameters of skin**

**a) The level of epidermis hydration**

The graph below shows the change in the value of the moisture level of the probands. It should be remembered that the subjects (n=30), apart from trial zero, were subjected to the treatment and care application of the Pyretrin-D series

(Fig 6). The results were averaged. All measurements were made on the cheeks and in the T-zone.



**Fig. 6 Change in the moisture content of the probands' skin before and during the test (n=30), \* - p <0.05, a.u. - arbitrary unit**

Based on the chart above, it can be seen that all the people who participated in the study had better results of the moisturizing parameter as the experiment progressed. The skin is a complex mechanism that tries to restore its proper biophysical parameters. The interaction of guanine and proteases present in the faeces of this parasite may result in an immune response and activation of protease inhibitors, which in turn inhibit the synthesis of NMF and lipids. Disruption of the integrity of the lipid-epidermal layer is characterized by increased penetration of irritating or allergenic components. The intensification of skin sensitivity to cosmetics may also be the result of the way it is cleansed [11]. The efficiency of the epidermal barrier is also determined by the presence of serine and cysteine protease in the stratum corneum. Correct exfoliation of the epidermis is conditioned by the distribution of proteins within the corneodesmosomes, where serine proteases also regulate stratum corneum lipid synthesis. They cause the degradation of extracellular lipid processing enzymes leading to a reduction in the secretion of the stratum corneum lipids by the lamellar bodies. The degradation of connections between corneocytes is also caused by the activity of cysteine proteases which in turn is regulated by the activity of the appropriate inhibitor - cystatin. In the healthy epidermis, cystatin is also secreted on its surface together with sweat providing protection against exogenous proteases produced, e.g., by Demodex, house dust mites, or golden staphylococci [12]. The proteolytic degradation of desmosomes due to the activity of proteases and the deactivation of inhibitors plays a key role in the natural process of exfoliation of epidermal cells. This process is also, to a large extent, dependent on the lipids of the intercellular matrix. The "turn over" exfoliation

affects the maintenance of proper humidity with proper NMF synthesis and thus the pH value of the lipid coat. Epidermal replacement

It is a natural process that cleanses the skin of toxins, bacteria, and mite droppings; the rate of renewal decreases with age. The impairment of the barrier function in demodicosis is manifested by a significant decrease in the level of hydration. Therefore it requires, in particular, the application of a cream containing a ready-made moisturizing complex that can supplement the necessary concentration of NMF. Thanks to the use of lactic acid, sodium lactate, urea, black cumin oil, arginine, and Karite butter extract in the recipe, the level of hydration has improved. Karite butter is characterized by a high content of triterpene esters 50-65% containing i.a. lupeol, A-amyrine, β-amyrine, cinnamom, Butyrospermum and acetates. This ingredient has actively improved the epidermal barrier.

The time needed to restore the appropriate hydration parameter would have been much longer if the discussed care had not been applied. Changes in the hydration parameter ranged on average in the range of 20-60 [j.u.]. Table 1 presents the interpretation of the results. The longer the time of using the series, the more the parameter improved.

**Tab.1. Interpretation of the epidermal hydration measurement results.**

Interpretation of the epidermal hydration measurement results		
	The degree of hydration of the epidermis	Measurement result [j.u.]
1	Very dry skin	<30
2	Dry skin	30-45
3	Sufficiently moisturized skin	>45
4	Poor condition of the skin	25-30
5	Critical condition of the skin	>30

Based on the above chart, it can be seen that all the people who participated in the study had better results of the TEWL parameter as the experiment progressed. Changes in the transepidermal water loss parameter ranged on average between 30 - 7 [g/hm<sup>2</sup>]. The longer the application time of the Pyretrin-D series, the more the parameter improved.

The natural lipid barrier of the skin protects not only against excessive transepidermal water loss (TEWL) but also against excessive penetration of toxic substances. The epidermal barrier efficiency is determined by the value of the transepidermal water loss (TEWL) factor [12]. Graph 7 shows that the components and the physicochemical form of the Pyretrin-D series contributed to the improvement of the epidermal barrier efficiency of the probands.

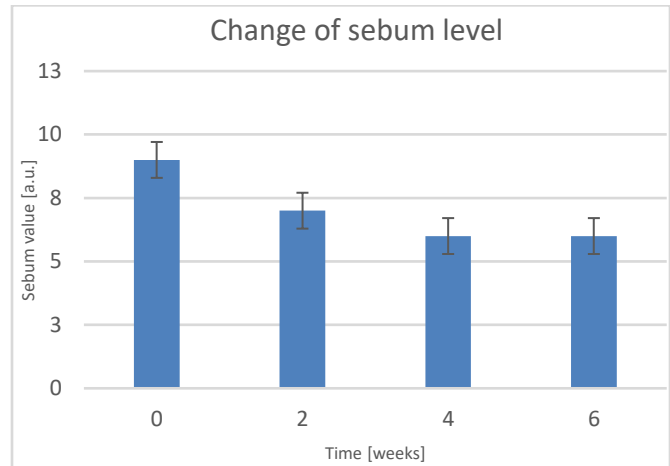
The increasing activity and concentration of the aforementioned cysteine and serine stratum corneum proteases present in *Demodex* feces within the sebaceous glands have a direct impact on the integrity of the epidermal-lipid barrier. The association with increased activity of stratum corneum proteases and decreased activity of inhibitors such as cystatin is the result of increased epidermal pH (towards alkalization) and TEWL index [13]. The symptom of erythema resulting from an inflammatory process should also be distinguished from erythema resulting from transepidermal water loss (TEWL) or neovascularization in the papillary layer, which is manifested by permanent vascular changes. Inflammatory erythema resulting from the toxic effects of *Demodex* feces, the typical symptom of which is redness and swelling, differs from paroxysmal erythema that occurs as a result of external physical factors caused by drying and dysfunction of the lipid-epidermal barrier. This phenomenon can be explained by the increased vascular-capillary flow, which determines proper nutrition and hydration, especially with increased transepidermal water loss due to changing external factors, i.e., temperature change. Subjecting the probands to chemical exfoliation with mandelic acid and then introducing home care routine with substances such as urea and sodium lactate stabilizing it moisturized the epidermis, and thus delayed TEWL and TEUL (Transepidermal Urea Loss), i.e., loss of urea from the skin.

The use of a moisturizing emulsion containing 5% urea resulted in the disappearance of negative symptoms within a week. Urea has an indirect moisturizing function, as it does not show hygroscopic properties, sometimes falsely declared by cosmetic manufacturers. Urea modifies the chemical structure of proteins in epidermal cells, shielding the binding sites for water and thus increasing its content in the stratum corneum. This property reduces transepidermal water loss (TEWL), which depends on the decreasing water content gradient in the epidermis and dermis. Patients, thanks to daily care chosen in this way, derived comfort from the treatment, as the epidermis was not dry, and they did not feel any burning during the application of the peeling.

#### **b) Measurement of the lubrication level**

The chart below shows the change in the value of skin lubrication of the probands. It should be remembered that the subjects (n=30), apart from trial zero, were subjected to the treatment and care application of the Pyretrin - D series (Fig

9). The results were averaged. All measurements were made on the cheeks and in the T-zone.



**Fig. 9 Mean change in the sebum value of the probands performed during the study (n=30), \* - p < 0.05**

With facial skin, where the activity of the sebaceous glands is naturally increased (the natural habitat of *Demodex* mites as contrasted to other parts of the body), the risk of the toxic effects of these mite metabolites increases [14]. This may be favored by environmental conditions in human skin, which result from the disturbance of the natural process of exfoliation and renewal of the epidermis, leading to slower self-cleaning of sebaceous glands from *Demodex* faeces (guanine and protease) [15]. It is also highly probable that the chronic toxic effects of *Demodex* metabolites may disrupt the antioxidant protection system, thus leading to inflammatory changes and dysfunction of the epidermal-lipid barrier. It was found that lipid peroxidation products are present in chronic inflammatory processes. Current research results have shown that a chronic wound contains a smaller amount of carbonyl proteins, i.e., products of protein oxidation, than an acute inflammatory lesion. This probably means that in the healing process, lipids are the main target of oxidants in the chronic inflammatory process of the skin [3]. This fact may explain the changes in sebum properties towards seborrhoea, including seborrheic dermatitis, the formation of blackheads, and the thickening of the epidermis. It has been shown that when the skin is not washed with detergent and water, the level of certain long-chain saturated fatty acids decreases, while the level of myristic acid increases significantly. This ingredient can aggravate acne problems and clog pores. The change of the sebaceous microenvironment plays an important role in the reproduction of mites, which is why it is so important to use a micellar foam or emulsion, which should be rinsed with water and then followed with a tonic. The presence of vitamin E in the series counteracts the effects of autooxidation of sebum, protecting unsaturated compounds against degradation. It helps to cleanse the sensitive skin of

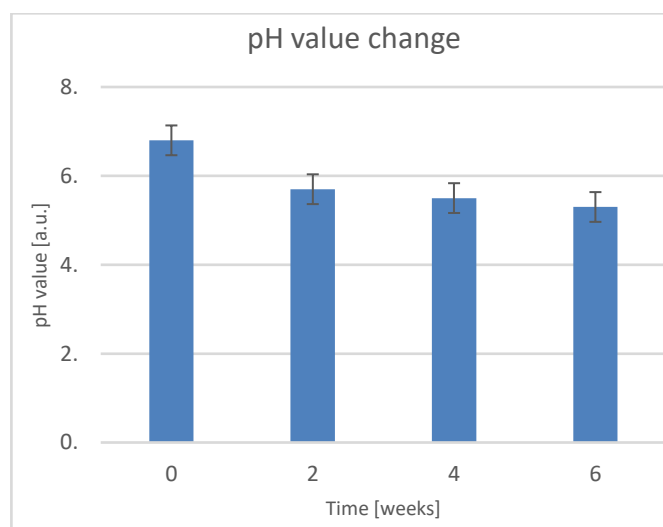
excess sebum, sebaceous plugs, an infection caused by demodicosis, and secondary pollution from cosmetics. After regular use of the Pyretrin-D series, the lubrication levels improved. The above assumptions are confirmed by Chart 9. The mean value of the examined parameter ranged between 9 - 6 [j.u.] depending on the duration of the study. The table below presents the interpretation of the lubrication level.

**Tab.3. The interpretation of the lubrication level results is as follows:**

The interpretation of the lubrication level results		
	The level of sebum	Measurement result [j.u.]
1	Low (dry skin)	0-6
2	Normal	>7
3	High (oily skin)	...

**c) Measurement of the pH value**

The graph below shows the change in the pH value of the probands. It should be remembered that the subjects (n=30), apart from trial zero, were subjected to the treatment and care application of the Pyretrin-D series (Fig. 10). The results were averaged. All measurements were made on the cheeks and in the T-zone.



**Fig. 10 Mean change in the pH value of the probands performed during the study (n=30), \* - p <0.05**

A very important factor affecting enzymatic processes participating in cell proliferation is the pH value. In healthy children after birth, its value is close to neutral (pH 6.5). After a few weeks, it changes and reaches the level typical for adults, namely pH 5.3 - 5.9. The pH value of the epidermis is influenced by endo- and exogenous factors, such as phospholipase A2, NMF components, sweat or sebum components, bacterial metabolites, or organic and inorganic chemical compounds applied to the skin [16]. Symptoms similar to the frequently reported problem - allergy to cosmetics - in demodicosis conditions may also be caused by the increased sensitivity of the TRPV1 receptor (transient receptor potential vanilloid subtype) [6]. This receptor is sensitive to many chemical stimuli, including temperatures greater than 42° C and high pH values. Skin infected with demodicosis, similarly to healthy skin, becomes more alkaline immediately after washing with formulations characterized by high pH values. In pathological conditions, the use of, for example, soap may lead to a much greater difference in the pH of the lipid coat, perceived by the receptor as a chemical burn [6]. These symptoms may be aggravated by the increased contact of the cosmetic ingredients with infected skin. In the case of healthy skin, the ingredients do not penetrate so deeply and do not irritate. In the Pyretrin-D series, citric, lactic, and almond acids are responsible for regulating the pH value of the skin. The effectiveness of their action depends on the pH of the cosmetic. To increase its availability, the active acidity of the cosmetic must be below. In the created peeling, in order to achieve a strongly acidic reaction (pH 0.5 - 0.8), citric acid was added because then the preparation penetrates deeper and guarantees that most of the acid molecules will remain undissociated. It was found that cosmetics with mandelic acid effectively affect the exfoliation process only when they are present in a concentration within 5-10% and the pH is 3.0 - 4.5, and in peelings with an acid content above 40%, when the pH is 1.0- 1.5 [6].

It has also been found that the acquired sensitivity to cosmetics in the course of demodicosis is caused, i.a., by the weakening of the lipid-epidermal barrier and an increase in the pH of the epidermis [17].

**IV. CONCLUSIONS**

The type of skin colloquially called capillary is undoubtedly a complex of symptoms resulting from the disturbance of the hydrolipid barrier due to improper care, disease conditions, intensification of demodicosis, and the full effects of rosacea in adulthood. Initially, in periods of exacerbation of the disease, erythema occurs as a symptom of skin dysfunction, and then, in the period of remission, neovascularization occurs. Most often, such symptoms are misdiagnosed.

The key issue is the pathomechanism of demodicosis, which exposes the skin to house dust mite-like pathogens, i.e., fecal and dead antigens. However, the route of penetration of these toxic compounds is important. In the



case of demodicosis, the pathogenesis often cited in the literature is based on the infection of the parasite itself with the *Bacillus oleronius bacterium*. In the opinion of the authors, more important is the presence in the glands of faeces and contaminants from the decomposition of dead individuals.

In demodicosis, the skin is polluted with mite faeces "from the inside." Thus, in addition to dermatological and ophthalmic treatment aimed at biocidal activity, it is necessary to develop appropriate hygiene habits for the patient to cleanse the skin of pathogens. These habits should boil down to thorough daily washing of the skin with foam or micellar emulsion with water, followed by toning and exfoliation. These activities are to gradually lower the skin's pH to acidic due to antibacterial prophylaxis, and at the same time, raise the skin's chemical tolerance threshold and reduce its sensitivity. There has also been widespread overuse of antibiotic therapy and a lack of research into demodicosis in people with symptoms of rosacea. When using exfoliating procedures, it is recommended to use antioxidants in the treatment of demodicosis, as they protect the skin against chemical stress, as well as components supplementing and activating the production of NMF. It is also advisable to use soothing base ingredients biocompatible with intercellular cement that actively rebuild the epidermal barrier. The reduction of the level of mite excrement is mainly due to active substances such as a) *Tanacetum Cinerariifolium* - Dalmatian tansy - a specially selected ingredient of the series, rich in natural pyrethrins (natural pesticides). b) Tea tree oil, which has anti-inflammatory and soothing properties, is bacterio- and fungistatic. c) Geranium oil smoothes and cleanses the skin, while d) Linalool is characterized by anti-inflammatory, antifungal, antibacterial, and antioxidant properties.

Taking into account the advantages of the proposed in-office and home care procedures for sensitive skin caused by demodicosis, it is reasonable to establish close cooperation between a dermatologist and a cosmetologist. The current concept of commonly used antibiotic therapy without individually selected skin hygiene and exfoliation seems irrational. In patients who used the Pyretrin-D series, a reduction or complete elimination of inflammation was noticed. Reduction of erythema and closing of the vessels on the nose and cheeks were also obtained. In all the participants, improvement in the protective mechanisms of the epidermis was noted, thanks to which the inner layers of the skin are better protected. This prevents infections caused by various microbes. People who struggled with Demodex folliculorum noticed a great improvement. By eliminating the excrements of this mite, the existing inflammation was reduced. All patients noticed that the pores on the surface of the skin were open before the procedure and the application of cosmetics. After participation in the study, they were closed, which was followed by the regulation of the sebaceous and sweat glands activity: secretion of sweat and

sebum. Patients were fully satisfied with the results. All assessed the effects of the preparations and treatments as effective and in line with the manufacturer's declaration. The degree of acceptance of the preparations by the volunteers was very high. Finally, the feelings of the probands participating in the study regarding the cosmetics used were very positive.

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