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BODY CLEANSING TISSUE INNOVATION WHICH CONTAINS PIONIN, ALOE VERA, LEMONGRASS EXTRACT, SULFUR, ALOE VERA AND ALPHA HYDROXY ACID IN ORDER TO PREVENT BACTERIAL AND FUNGAL INFECTIONS ON THE SKIN

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ABSTRACT

Hygiene problems are often one of the causes of infection problems on the skin, whether caused by bacteria, viruses, or fungi. Hygiene problems are important, especially for groups that are difficult to maintain hygiene or difficult to bathe, such as the population who is resting on bed rest. Therefore we need a method to maintain skin hygiene even though not bathing. One of them is to make a tissue cleanser that can be used to clean the whole body. The purpose of this study is to demonstrate the laboratory effectiveness of tissue cleanser formulations for the body in terms of killing microorganisms, particularly fungi and bacteria, in order to reduce the incidence of skin diseases caused by hygiene issues. This composition is in accordance with the Regulation of the Head of the Drug and Food Control Agency of the Republic of Indonesia Number 12 of 2019 concerning Contaminants in Cosmetic. Testing the effectiveness or antimicrobial effect of the product has an effectiveness level of 99.98 to kill S. aureus with a contact time of 30 seconds and 99.99% for a contact time of 60 seconds. While the antifungal effect has an effectiveness level to kill C. albicans of 92,50% for a contact time of 30 seconds and 95.00% for a contact time of 60 seconds. The bodily tissue cleansing mixture has been clinically shown to kill bacteria and fungal infections. Hopefully, in the future, it will be able to eliminate body odor.

Keywords: *body odor; microorganism of skin; pionin, sulfur; bacterial; fungi*

1. INTRODUCTION

The physical and chemical properties of the skin determine the types of microorganisms that adapt according to the area of the skin inhabited. The habitat of microorganisms is determined based on the thickness of the skin, the folds and the density of the hair follicles and glands.(MacLeod et al., 2009)

Eccrine sweat glands are found almost all over the surface of the skin and have a secretion composed of water and salt. Its main functions are regulation of body temperature, excretion of water and salt, acidification of the skin and preventing

colonization and growth of microorganisms. The apocrine sweat glands found in the axilla, nipple and genitoanal are stimulated by adrenaline by producing thick, odorless and milky secretions. It is thought that the secretions of these glands contain pheromones. Stereotypes of body odor are related to sweat, microorganisms and apocrine gland secretions. The sebaceous glands communicate with the hair follicles and secrete a secretion in the form of sebum which is rich in fat. This secretion functions for lubrication and protection from skin and hair pathogenic bacteria. (Agarwal & Krishnamurthy, 2019; Yousef et al., 2020)

Some areas of the skin that are partially covered such as the genital area, axillae and between the fingers have higher humidity and temperature thereby increasing the growth of several microorganisms such as: gram-negative bacilli, corynebacterium and S. aureus. In areas with high humidity and low temperatures have a high number of gram-negative bacteria. In most areas of the skin that are not covered and dry found a combination of microflora consisting of Staphylococcus, Micrococcus, Actinobacteria, Proteobacteria, Firmicutes and Bacteriodetes. Areas that have a high density of sebaceous glands, namely the face, chest and back, increase the growth of lipophilic microorganisms such as Proprionibacterium and Malasezzia. Host-specific factors such as age, anatomic location and sex influence the variability of the skin microflora. Inside the uterus, the baby's skin is still sterile, bacterial colonization occurs shortly after the baby is born. During puberty, changes in sebum production affect the number of lipophilic bacteria on the skin. Physiological and anatomical differences between men and women in the production of sweat, sebum and hormones partially affect the skin microflora. Individual specific environmental factors such as occupation, clothing, use of cosmetic products, use of antibiotics can modulate skin microflora colonies. Ultraviolet light has a bactericidal effect so that geographic variability based on latitude and longitude will affect the skin microflora. (Sanford & Gallo, 2013)

The main function of using cleansing cosmetics is cleanliness and freshness by removing grease, dirt and bacteria from the surface of the skin. Each type of cleaner must be adapted to its use. This research is to prove the laboratory effectiveness of tissue cleanser formulations for the body in terms of killing microorganisms, especially fungi and bacteria in terms of reducing the incidence of skin infections due to hygiene problems.

2. METHOD AND MATERIAL

The body tissue cleansing formulation contains pionin 0.08-0.12%, aloe vera 2.4-3%, lemongrass extract 0.04-0.06%, sulfur 0.4-5% and alpha hydroxy acids 1,6- 8%, then added with aquabides as a solvent until it reaches a concentration of 100%. Having antimicrobial, antifungal, refreshing/aromatherapy effects and eliminating bad body odor, this formula provides added value when traveling, when caring for sick people, when working overtime, when not being able to take a shower. This research was carried out in an accredited laboratory, namely SIG.

This research was conducted on September 24, 2021 with the test sample number being 21J013SSTBS-B. The experiment was carried out with a test temperature of 24 degrees Celsius and the incubation temperature for the test bacteria was 35 degrees Celsius, while for fungi it was 25 degrees Celsius. The test bacteria used in this study was Staphylococcus aureus (ATCC 6538) while Candida albicans (ATCC 10231) was used for the test fungus. There are also other parameters that were tested in this study in the form of Yeast Mold Number, Total Plate Number, and Pseudomonas aeruginosa. The initial amount given for S. aureus test microbes was

50,000,000 CFU/mL and C. albicans was 240,000 CFU/mL with contact times of 30 seconds and 60 seconds. Statistical analysis used in this study is descriptive statistical exposure.

3. RESULTS

Testing of body cleansing tissue formulation containing pionin 0.08-0.12%, aloe vera 2.4-3%, lemongrass extract 0.04-0.06%, sulfur 0.4-5% and alpha hydroxy acid 1 ,6-8%, the final results showed that the number of yeasts was < 10 colonies/g, the total plate number was < 10 colonies/g, Staphyloccus aureus was negative, Pseudomonas Aeuriginosa was negative, and Candida albicans was negative. This composition is in accordance with the Regulation of the Head of the Drug and Food Control Agency of the Republic of Indonesia Number 12 of 2019 concerning Contaminants in Cosmetics

Testing the effectiveness or antimicrobial effect of the product has an effectiveness level of 99.98 to kill S. aureus with a contact time of 30 seconds and 99.99% for a contact time of 60 seconds (Table 1). While the antifungal effect has an effectiveness level to kill C. albicans of 92,50% for a contact time of 30 seconds and 95.00% for a contact time of 60 seconds. (Table 2)

Test results (Table 1)

Test microbe: Staphylococcus aureus

Contact Time	**Initial number of microbes in suspension**	**Number of living microbes**	**Presentation of killed microbes**
	CFU/ml	**CFU/ml**	**%**
30 sec	50000000	$8,4 \times 10^3$	99,98
60 sec		$2,2 \times 10^2$	99,99

Test results (Table 2)

Test microbes: Candida albicans

Contact Time	**Initial number of microbes in suspension**	**Number of living microbes**	**Presentation of killed microbes**
	CFU/ml	**CFU/ml**	**%**
30 sec	240000	$1,8 \times 10^4$	92,5
60 sec		$1,2 \times 10^4$	95,0

4. DISCUSSION

A. Host–pathogen interactions

Historically, the most research has focused on microbe–host interactions that drive (or result from) infectious processes. A classic host–pathogen relationship in the skin entails a one-to-one mapping of microbe to illness and a readily identifiable phenotype of inflammation. The majority of

what we know about the skin immune system has come through studying interactions like these, demonstrating the value of this simple paradigm but also anticipating its limitations. As we will see, most microbe–host interactions on the skin are more subtle; for example, conventional pathogens frequently dwell on the skin's surface asymptomatically.(Chen et al., 2018)

S. aureus is one of the most significant infections of the skin in terms of both expense and prevalence. Although S. aureus colonizes more than 30% of healthy people asymptomatically, it can cause a wide range of infections: some are limited to a single hair follicle (furuncle), others involve subcutaneous tissues (cellulitis), and the most serious feature is potentially fatal penetration into any organ in the body, including bone (osteomyelitis), bloodstream (bacterial sepsis), and heart valves (bacterial endocarditis). S. aureus has also been linked to the development of chronic illnesses such atopic dermatitis and, more recently, systemic lupus erythematosus with renal and skin involvement. (Byrd et al., 2017; Conti et al., 2016; Totté et al., 2016)

S. aureus is a multifaceted pathogen with a diverse set of virulence factors that include neutrophil-killing toxins, chemotaxis inhibitors, anti-phagocytic and anti-killing surface molecules, superantigens, and immune evasion proteins. S. aureus isolates develop as biofilms on the skin of atopic dermatitis patients and generate proteases that destroy host AMPs such as cathelicidin LL-37. At every level of the epidermis and subcutaneous tissue, the host has evolved mechanisms to prevent S. aureus invasion. Aside from a wide arsenal of AMPs covering the epidermis, research suggests that adipose tissue underneath the dermis contributes to the innate immune response. Following a breach of the epidermal barrier and subsequent S. aureus infection, local pre-adipocytes multiply rapidly, extending the subdermal fat layer and boosting AMP cathelicidin synthesis.(Chen et al., 2018)

Although some virulence and immune evasion components are shared by all S. aureus species, there are significant strain-level variations. The arginine catabolic mobile element, for example, contributes to USA300, a methicillin-resistant S. aureus strain, being able to live in the acidic environment of human skin and resist host polyamines, which helps to explain this strain's predominance in skin and soft tissue infections. Recent research has also revealed that specific strains of S. aureus are not only connected with more severe atopic dermatitis, but are also capable of inducing skin inflammation in mice regardless of host genetic susceptibility. This study found that the most popular technique of characterizing microbiome composition, using genus- or species-level data, fails to resolve substantial functional changes across strains, which can come from minor gene gain or loss events or even variations in gene expression between strains. (Byrd et al., 2017; Joshi et al., 2011)

The peripheral nerve system's involvement in skin immunity may be more broad and integral than previously acknowledged. Candida albicans, a fungal disease, also directly stimulates sensory neurons, which then boost host immunity and activate protective IL-17-producing dermal T cells. S. aureus also directly stimulates cutaneous neurons via N-formylated peptides and the pore-forming toxin -haemolysin, causing pain as well as neuropeptide-mediated vasodilation and inflammation. A direct mechanistic connection between neurons and immune cells has just been found. In the gut, for example, mucosal neurons generate a neuropeptide called neuromedin U (NMU), which binds to an NMU receptor on group 2 innate lymphoid cells (ILC2s) and activates a protective immunological response. In a recent case, a microbiota-derived metabolite (isovaleric acid) was shown to trigger a

receptor enriched in enterchromaffin cells, resulting in the basolateral release of serotonin, which stimulated sub-epithelial enteric nervous system afferents. (Bellono et al., 2017; Cardoso et al., 2017; Chiu et al., 2013; Kashem et al., 2015)

B. VOLATILE ODORS

The majority of volatile odorous molecules released from the skin's surface are produced from perspiration, which is a result of sweat gland production. Human sweat glands are classified into three types: apocrine, eccrine, and apoeccrine (mixed). Eccrine glands generate a lot of perspiration, which is mainly water and electrolytes. They cover virtually the whole surface of the body. Apocrine glands, on the other hand, are primarily found in the axillary, perineal, vaginal, and nipple areas. They begin to function after puberty and produce less perspiration than eccrine glands. Apocrine sweat is odorless until it is broken down by microorganisms that live on the skin's surface, such as Micrococcaceae, aerobic diphtheroids, and Propionibacteria. Apocrine glands release sweat similar to eccrine glands, but their rate of secretion is faster, and they are more common in the axillary area. Because of these characteristics, apocrine glands are important contributors to axillary perspiration.(Semkova et al., 2015)

Changes in hormonal balance, food consumption, and metabolic changes may all have an effect on the quantitative and qualitative composition of sweat. Because the human organism is in symbiosis with numerous microbial species capable of transforming sweat chemical components, changes in skin microbiota as well as bacterial illnesses may affect the composition of perspiration, frequently generating an unique odor. For example, in streptococcal intertrigo, patients' skin has been observed to have a characteristic unpleasant odor.(Honig et al., 2003)

C. EFFECTIVENESS OF THE COMPOSITION IN INHIBITING MICROORGANISMS AND ELIMINATING BODY ODOR

Skin cleansing cosmetics are divided into 4 groups, namely water based cleansers, oil based cleansers, solid cleansers and scrub cleansers. Water based cleansers are the type most often used, for example astringent lotion. In order to have a strong cleaning power, it is necessary to add a surfactant in the water, but it is necessary to pay attention to the type of surfactant used because it can cause dry and irritated skin. Oil based cleansers are effective at removing oil soluble impurities and generally have greater cleaning power such as cleansing creams and cleansing milks. Solid cleansers clean by absorbing dirt into solid flakes usually in the form of a powder or cream whose solid powder will form after the solvent evaporates. This preparation is suitable for people who cannot tolerate soap but have a higher risk of developing allergies. Scrub cleansers can remove dead skin cells effectively which other types of cleansing cosmetics cannot.(Ahmad & Ahsan, 2020)

Surfactants are the main active components of cleaning formulations. Some other components that are usually added in cleaners are perfumes, structures, emollients and humectants. Perfume is the most expensive component of soap and determines the selling price to consumers. The structure is used to maintain the solid form of the soap. Emollients are used to reduce the drying effect of surfactants. Humectants are added to moisturize the skin. Disinfectants can also be added to remove pathogenic microorganisms.(Falk, 2019)

Pionin or photosensitizer (3-heptyl-2-[3-heptyl-4-methyl-2(3H)-thiazolylidene)methyl]-4-methylthiazolium iodide is a component recognized in Japan

as a quasi-drug in 1962 and a cosmetic ingredient since 1967. Pionin is known to have a high antibacterial effect and can be effective in killing Proprionibacterium acnes so it is widely used in antiacne preparations. In one study, it was found that the use of 0.005% pionin in the form of soap significantly reduced the number of papules and pustules in acne compared to placebo. Pionin works effectively at relatively small concentrations in cosmetic products.(Mori et al., 2003)

Lemongrass essential oil (Cymbopogon citratus) has potential anti-inflammatory and antifungal effects on the skin. In a study comparing four types of essential oils, it was found that lemongras has an antibacterial effect on Methicillin Resistant Staphylococcus Aureus and does not cause skin irritation. This essential oil can also be useful as a mosquito repellent, especially in the form of hydrophilic preparations.(Boeira et al., 2020)

Aloe Vera is a plant that is widely found in the tropics and is known to have many uses in the field of dermatology. Topical Aloe Vera functions in wound healing, protection against UV and gamma radiation, anti-inflammatory, moisturizing, antiaging, and antiseptic. Generally, topical aloe vera is used in burns, psoriasis, and seborrheic dermatitis.(Lavanya et al., 2019; Sandhya & Gowri, 2017)

Sulfur (S16) is an element that is found and used in various types of industries. In dermatological preparations, octasulfur (S8) is generally used. Topical administration of sulfur acts as a keratolytic, fungicide, and bactericidal. Sulfur is used in acne, seborrheic dermatitis, rosacea, scabies and various skin infections.(Gupta & Nicol, n.d.)

Alpha hydroxy acids are a class of hydroxy acids that are widely used for peeling. This component works by thinning the stratum corneum, causing epidermolysis, scattering melanin in the stratum basale, and increasing collagen synthesis.(Tang & Yang, 2018)

The formulation of the cleanser solution was made by mixing pionin 0.08-0.12%, aloe vera 2.4-3%, lemongrass extract 0.04-0.06%, sulfur 0.4-5% and alpha hydroxy acid 1, 6-8%, then added with aquabides as a solvent until it reaches a concentration of 100%. The cleaning solution is mixed with tissue sheets measuring 18-54 cm x 16-48 cm which are processed in a machine. The output is body tissue that has been wrapped in a special container. The container states how to use it.

The formulation of this cleanser has broad antibacterial and antifungal effects so that it can effectively cleanse the skin of disease-causing germs and prevent the formation of unpleasant body odors, aromatherapy. This formulation also has a keratolytic effect which helps to shed dead skin cells. By making a cleanser in the form of body tissue, it provides added value from the practical side. The present invention is intended for various situations where it is difficult to take a shower such as when traveling, caring for the sick or while working overtime. This invention is expected to provide convenience for cleaning the body, preventing body odor and making the body feel fresh again so as to increase productivity.

5. CONCLUSIONS

The body tissue cleansing formulation contains pionin 0.08-0.12%, aloe vera 2.4-3%, lemongrass extract 0.04-0.06%, sulfur 0.4-5% and alpha hydroxy acids 1.6-8% which have been laboratory proven to eliminate bacteria and fungi pathogens. Hopefully in the future it can get rid of body odor

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