



Ayurved Insights for Sustenance of Microbial System- A Review

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Abstract

Microbes which are considered as the life within a life. There are some connections and interrelations of microbial metabolism and Ayurvedic regimen (Dinacharya). The daily regimen explained in Ayurveda is the ideal example of sustenance of body cells. The distribution of microbial mechanism over the substratum, biofilm and the mucus epithelium of each and every layer of body parts such as eye (conjunctiva), Oral cavity (buccal mucus epithelium) and the epidermal layer of skin and majorly the gut is clearly understood. routine procedures which should be regularly done by a healthy person. These procedures contain such type of herbs and oils as means of execution of these procedures, which maintain the normalcy of Dosha, Dhatu Mala (normal factors of metabolism as per Ayurveda). It is essential to carry out periodical removal of pathogenic microbes and make arrangement for growth and colonization of commensal microbes, which can be achieved as the wonder of procedures in Ayurveda advised daily regimen comprising of Dantadhavan, Gandusha, Anjana, Abhyanga and Udvartana etc and the diet regulating methods.

Key words- Microbes, Dinacharya, Udvartana, Gandusha, Abhyanga, Anjana, Langhana

Introduction

Microbes which are a part and parcel of our body, are the “life within a life. As microbes have a synergistic relation with a human body, the wellbeing of microbes and human system seems to be parallel and proponent pathways. Being the doctor of Ayurveda, some connections and interrelations of microbial metabolism and Ayurvedic regimen, and some trustworthy areas are shared. Dinacharya that is the daily regimen explained in Ayurveda is the ideal example of sustenance of body cells which maintain the normalcy of Dosha, Dhatu Mala (normal factors of metabolism as per Ayurveda). Dantadhavan and Gandush- (Brushing and Gargling, oil pulling)

- 1) Ubatan- powder massage
- 2) Abhyang- oil application on skin
- 3) Nidra- (sleep at night)
- 4) Vyayam- (Exercise)
- 5) Anjana- (Collyrium)

These are the routine procedures which should be regularly done by a healthy person. These procedures contain such type of herbs and oils as means of execution of these procedures, which maintain the normalcy of Dosha, Dhatu Mala (normal factors of metabolism as per Ayurveda). After thorough understanding of microbial mechanism, it is now clear that the substratum, biofilm and the mucus epithelium of each and every layer of body parts such as eye (conjunctiva), Oral cavity (buccal mucus epithelium) and the epidermal layer of skin are the sights of the microbial stay.

Ubtan/ Udvartana and Abyanga are the procedures mentioned in Ayurveda for maintenance of cellular wellbeing by maintaining the normal status of Dosha there. Udvartana is a gentle scrapping kind of regimen which is known to remove the dead cells, debris, dirt or plaques from the skin. According to microbial literature review it seems that it is essential to carry out periodical removal of pathogenic microbes.

The wonder of Ayurveda regimen is that it advises association of Abhyanga as predecessor of Udvartan. The Abhyanga is carried out prominently with Sesamum oil singular or medicated. Which is capable to create substratum for sustenance of commensal microbes. Likewise Anjana is similarly working in context of microbial sustenance in conjunctival area and so on.

Aim and Objective– To state a review of Ayurvedic insights for sustenance of Microbial system.

Methodology –

- To state extensive review study of microbes in oral cavity and its Ayurveda insights.
- To state extensive review study of microbes on skin and its Ayurveda insights.
- To review microbes related to eyes and its Ayurveda insights.
- To study microbes in relation to diet, sleep and exercise pattern and its Ayurveda insights.

Discussion -

1) Dantadhavan (Brushing teeth) and Gandush- (Oil Pulling)-

Oral cavity is one of the most well-studied microbiomes till date with a total of 392 taxa that have at least one reference genome and the total genomes across the oral cavity approaching. Diversity in the microbiome is individual specific and site specific, despite the similarities. The tongue has numerous papillae with few anaerobic sites and hence harbors a diverse microflora which also includes anaerobes. Oral microbiome may show large and rapid changes in composition and activity both spatially and temporally and are developmentally dynamic with the host. These multiplex, nonequilibrium dynamics are the result of many factors, such as the

temporal frequency of host and diet, the response to the changes in pH, interactions among the bacteria and, on a larger time frame, gene mutations and horizontal gene transfer that extend new properties to the strain.

Firmicutes in oral cavity-One study observed that the supragingival plaque of healthy subjects is mainly made up of Firmicutes and Actinobacteria (genus *Corynebacterium* and *Actinomyces*), which tend to generate acid, can survive in low pH environments, and are responsible for caries. As it moves from the surface of the teeth to the subgingival area, along the root, the microbial biofilm changes its characteristics: there is more serum and less saliva, the environment becomes more anaerobic, and the pH and temperature become extreme.

Microbe as treatment in oral cavity-

Digestion begins in the mouth where food is mechanically broken down by chewing chewing not only reduces the size of food particles but stimulates the release of saliva which contains its own bacteria mouth has rich microbiome that strongly influence health of teeth and gums within mouth maintenance of balance in oral microbiome is very important for oral health also it can have implications and results for overall health of a human being. Some detrimental bacteria that grow in oral cavity may actually be linked to Greater risk for developing cardiovascular diseases for example the bacteria's in mouth that cause period on tight is which is an infection damaging the tissue and bones surrounding the teeth.¹

Currently, probiotics are also used in the treatment of various pathological conditions of the oral cavity that underlie a dysbiosis of the oral microbiota.²³

When the plaque and gingival scores and colony forming unit counts of patients were assessed before and after oil pulling. Oil pulling resulted in a statistically significant decrease in plaque, gingival scores and number of bacteria in the mouth. This paper explains about the dental benefits of oil pulling on plaque, gingivitis and mouth residing bacteria. Gingivitis is a bacterial infection due to long term effects of microorganisms present in plaque. Antibacterial mouth rinses like chlorhexidine are used as an adjunct to mechanical plaque control, but they are accompanied with side effects like staining, allergy and lingering after taste. All these suggest the need of a home remedy that the patient can practice as a preventive habit. 'Oil pulling' or 'oil swishing' is a procedure that involves swishing of oil in the mouth for oral and systemic health benefits. Oil pulling therapy with sesame oil has been extensively used as a traditional Indian folk remedy for many years for strengthening teeth and gums. sesame oil for oil pulling as it is known to have antioxidants namely sesamin, sesamol and sesaminol. The viscosity of the oil probably inhibits bacterial adhesion and plaque coaggregation. Another possible mechanism might be saponification or the soap-formation process that occurs as a result of alkali hydrolysis of fat. In the experimental study conducted, the parameters selected were plaque index, gingival index and colony forming unit count. These parameters were selected as they are interrelated to each other. Microorganisms cause plaque formation and plaque in turn causes gingivitis. Gingivitis when left untreated can progress to a more destructive form of periodontal disease. An effective modality of prevention which can arrest the disease progression and ensure healthy tissues is of import.

Effect of Oil Pulling with Sesame Oil on Plaque-induced Gingivitis:

Effect of Oil Pulling with Sesame Oil on Plaque-induced Gingivitis shown significant reduction of scores on days 45 due to oil pulling practice. From the results obtained it can be concluded that oil pulling has a significant effect on plaque and gingivitis. As the results are positive it can be said that oil pulling causes significant reduction in plaque as well as gingivitis even if it is practiced for such a short time like 45 days. If practiced daily it can be developed as a healthy

oral hygiene habit. From the CFU count values we can understand that oil pulling has an antibacterial activity as the results showed a reduction in the number of bacteria per milliliter after 45 days of oil pulling. The results of control group show that in some cases when plaque and gingivitis is left untreated, can progress to a more severe form as indicated by an increase in plaque and gingival scores.⁴

Composition and diversity of the oral microbiota –

Composition and diversity of the oral microbiota changes in the composition of the salivary microbiome can be used as a biomarker to monitor the prevalence and prognosis of diseases such as caries, oral cancer, and periodontal disease, and to reflect the oral and general health status⁵. Saliva is thought to greatly influence the colonization and clearance of microorganisms and to play important roles in the physical, chemical, and immunological defenses of the oral cavity⁶. It is involved in the formation of a protective liquid layer, the acquired pellicle, which participates in the microbial adhesion and colonization processes⁷

Tooth Surfaces and Oral microbial biofilms -

The tooth surface is the only non-shedding surface in the oral cavity and therefore provides an ideal environment for bacterial growth and the formation of dental plaque.⁸

Structure and Formation of Oral Microbial Biofilms- Oral microbial biofilms are complex ecological environments with plentiful and diverse oral microorganisms, which are associated with various oral diseases. **Bacterial Interactions During Biofilm Formation** Coaggregation occurs when two paired individual bacteria are suspended in the planktonic phase. However, “coadhesion” usually refers to a situation in which one microorganism is fixed to a surface and the co-adhering microorganism is suspended⁹. Binding is extremely important in the formation of multispecies biofilms, and depends on the adhesins expressed on the surface of one bacterium and the complementary polysaccharide-containing receptors expressed by the other species¹⁰. Communication between the same or different species is mediated by chemical signals synthesized and secreted by bacteria. These signals can be divided into two groups. One group is related to cell density and quorum sensing (QS), and the other group involves signals produced by bacteria at various stages of growth.¹¹ QS is a microbial cell-to-cell communication process principally dependent upon the population density. As the population density increases, signals accumulate locally, and once a threshold concentration is reached, the autoinducer interacts with the receptor protein. When different target genes are activated, the physiological behavior of the bacteria, such as their virulence, competition, pathogenicity, and drug resistance, is altered.¹²

Various factors affect the changes in oral microorganisms

After the colonization of the oral cavity, oral microorganisms undergo ecological succession and gradually form stable microbial communities. However, the ecological balance is also influenced by a variety of endogenous and exogenous factors. These factors, including drug use, host lifestyle, environment, and host status, contribute to differences in disease susceptibility by influencing the composition, structure, and metabolic functions of oral microorganisms..¹³

Antibiotic Utilization-

Antibiotics not only affect the composition and functions of the oral microbiome, but also induce specific metabolic changes during antibiotic interventions.¹⁴

It is noteworthy that the relative abundance of Actinobacteria decreased by 60% in the antibiotic-treated group after 1 week and remained 50% lower than baseline after 6 months. The abundances of Bacteroidetes and Fusobacteria also decreased significantly. In recent years, it has been reported that some common oral fungi are resistant to antifungal azoles.¹⁵ Antibiotics have a much smaller impact on the oral microbiome than on the gut microbiome.¹⁶

Dietary Changes and Oral Health

To develop a diet conducive to oral health, many scholars have investigated the relationship between diet and the oral microbiota. An investigation of the oral microbiota in infants showed that breast-fed infants had a higher proportion of Streptococcus, whereas formula-fed infants had higher proportions of Actinomyces and Prevotella. Moreover, breast and mixed-fed infants developed oral candidiasis at a lower frequency than infants who were fed solid food.¹⁷ In the oral cavity, a variety of endogenous and exogenous factors can alter the abundance and composition of the oral microbial communities, leading to microbial dysbiosis, the occurrence of oral caries, periodontitis, and other diseases, and even causing systemic diseases.¹⁸ The interactions among multiple microorganisms and the dysbiosis of the entire microbial community contribute to the progression of caries.

Ayurveda and Oral Health –

With review of the above references from biomedicine, it is clear that the oral hygiene and diet both are responsible for the oral diseases. The indigestion also plays a major role in the body mechanism. The indigestion in alimentary canal produces unwanted sticky material all over the body termed as Kleda. This Kleda can be correlated by various names, with various forms of unhygienic unwanted material throughout the body. In mouth on the enamel it can be related with the plaque, on tongue it can form tartar. The plaque thus formed due to indigestion generates pathogenic microbes in mouth alike the indigestion generates pathogenic microbes in intestine.

According to Ayurveda, in such conditions the Langhana treatment (Fasting/ limited eating therapy) is advised. It is responsible to control the indigestion in alimentary canal and thereby the plaque / tartar formation in mouth through the control of dysbiosis.

Another treatment according to Ayurveda is Dantadhavan and oil pulling. Dantadhavan removes the kleda and sticky matter from the oral cavity and teeth surface. These medicines are having bitter, astringent and Corrosive herbs base. Due to which they are capable of removing tartar and pathogenic microbes. As recommended by Bridgette Shea in her book cultivating microbes unlike many mainstream medicines mouthwashes containing alcohol may contribute to dysbiosis. On the contrary use of oil is nourishing to the commensal bacteria in the mouth. The oil's viscosity changes during the pooling process of oil pooling and removes pathological bacteria and tartar in addition to Gandush. Review from research articles suggests that sesame oil has antibacterial and antifungal properties. Hence is recommended traditionally for oil pooling. The ethno-pharmacologists believe in positive relation between the periodontal diseases and IBD.¹⁹ In addition to The sesame oil used in Oil Pulling generates biofilm for the commensal microbes. Hence, Ayurveda might have recommended Dantadhavan and oil pulling as a daily regimen since years together.

2) Ayurveda concept of Udvartan (The Powder Massage on body)

Skin diseases –Skin diseases can be caused by viruses, bacteria, fungi, or parasites. The most common bacterial skin pathogens are Staphylococcus aureus and group A β -hemolytic streptococci. Herpes simplex is the most common viral skin disease. Of the dermatophytic fungi, Trichophyton rubrum is the most prevalent cause of skin and nail infections.

Pyoderma literally means “pus in the skin” and can be caused by infectious, inflammatory, and/or neoplastic etiologies; any condition that results in the accumulation of neutrophilic exudate can be termed a pyoderma

Bad odor of body - Origins of body odor associated with bacterial metabolites. Malodor that is associated with accumulation of bacterial metabolites in body fluids might result from one or

more of the following causes: Gut function, Intestinal transit time and gut-blood barrier permeability affect penetration of bacterial metabolites and their precursors from the gut lumen to the bloodstream causing odor.

Causes and Biochemistry of Body Odor²⁰

The composition of the skin microbiota varies from one individual to another, and between locations on the same host; sometimes, even the left armpit can have a vastly different flora compared to the right. However, the major bacterial players that colonize the skin and produce body odor are similar. Some common skin bacteria that produce body odor include members of *Corynebacterium*, *Staphylococcus* and *Cutibacterium* genera. The biochemistry behind the microbial conversion of sweat to malodorous products is still not completely understood. However, the odor can be largely attributed to the production of volatile organic compounds (VOCs), including volatile fatty acids and thioalcohols. Volatile fatty acids that contribute to body odor include 3-methyl-2-hexenoic acid (3M2H), which has a 'goat-like' odor, and 3-hydroxy-3-methylhexanoic acid (HMHA), which has a 'cumin-like' odor. These odorants are produced by some members of *Corynebacterium*, including *Corynebacterium striatum*, *Corynebacterium jeikeium* and *Corynebacterium bovis*. Other medium- and short-chain fatty acids also contribute to odor. If you have smelly feet, it is probably because *Staphylococcus epidermis* has degraded the leucine in your sweat to isovaleric acid, a cheesy-smelling compound. Thioalcohols get their stinky odor from sulfur and, despite being present in only trace amounts, are some of the most pungent VOCs produced. 3-methyl-3-sulfanylhexan-1-ol (3M3SH) is a thioalcohol, produced by *Staphylococcus hominis*, which makes the underarms smell like rotten onions or meat.

It has been suggested that, similar to a fingerprint, every individual's body odor is unique and may be partly determined by genetics. Men have larger sweat glands and generally produce more sweat than women. This typically results in larger populations of *Corynebacterium* spp. and intensified cheese-like odor, due to the production of higher quantities of volatile fatty acids.

There aren't many evidence-based guidelines to manage body odor, but deodorants and antiperspirants are commonly used to reduce or prevent it. Deodorants contain chemicals that kill skin flora and block production of stinky byproducts. Antiperspirants reduce the amount of sweat produced by clogging sweat glands. Many contain aluminum chloride, which creates a gel-like substance that forms a plug at the sweat ducts in the skin. Many deodorants and antiperspirants also contain antimicrobials, like propylene glycol, triclosan and benzalkonium chloride, which decrease bacterial abundance and result in an altered skin microbiome in the armpits. However, the modified microbiome can have unintended consequences as well. For instance, a study showed that the use of antiperspirants resulted in an increase in odor-producing Actinobacteria in some individuals.

While deodorants and antiperspirants do the minimum job of reducing bacterial load and their byproducts, respectively, a growing body of work is focusing on the use of probiotics and artificial microbial communities to reduce malodor. The field is still in its infancy, but one technique being developed is armpit microbial transplantation. In preliminary work, scientists used antibacterials to remove the armpit microbiome from a person with BO and replaced it with bacteria from the armpit microbiome of a healthy (related) donor. Comprehensive results on the efficacy and success of the procedure have yet to be published. Innovative therapies along the lines of armpit microbiota transfers may offer respite and psychological relief to people with chronic body odor conditions. At the same time, scientists are unraveling the role of odor in certain diseases. Leveraging this understanding will help in the development of rapid diagnostic

tests, as well as treatments for a variety of pathogens and diseases. One factor that determines good skin functioning, is a properly working skin microbiome. This complex set of microorganisms consists of bacteria, fungi, viruses, micro-eukaryotes (mites), archaea, and phages.

Microbes and body odour –

Due to different microbes the different odours are expressed through the body secretions. There is a bacteria called as *Corynebacterium* which is present in the sweat, also in the secretions of vagina and it fights off the pathogens in the vagina and on skin. In Ayurved the function of sweat is understood to hold moisture as stated *SwedasyaKledaVidhruti*—the sweat ,when persists on the skin can protect the skin from infections, hence the sweat is essential. If the antiperspirants are given the sweat is not secreted and the protection against infections is lost.²¹ There was a small project conducted. Participants were divided in 3 groups. 1 Group was made to use deodorants, 2nd group-Antiperspirants and 3rd group none. After some days the group 1 and 2 were found to have difference in the microbial colonies, such that the *Staphylococcus* were exaggerated to triple, whereas *Corynebacteria* were reduced. The *Corynebacteria* actually has strong defensive mechanism against pathogens.²²

Udvartan as an Ayurvedic Remedy for Body odour-

The traditional herbal formulation exfoliates the body of the user and removes the dead skin cells and makes way for the new ones. Ubtan is also called “Udvartan” an Ayurveda treatment in the form of body massage that soothes skin and makes it soft and free of much unwanted micro-flora and dirt on the skin. It has been widely used in India and its subcontinents and Udvartan concept has a long-standing drug regulation concept and values, built for the recovery of body, mind, and soul.

From review of research done on Ubtan²³.Ubtan formulations (UF-1to UF-4) showed free radical scavenging and ferric reducing potential. It may be due to its high phenolic and flavonoid content.

Interactions between Skin Microorganisms—

The dominant resident species of skin bacteria are commensals. Together with immune cells and keratinized skin cells (replaced every four weeks), these are responsible for the appropriate skin immune barrier functioning There are diverse mechanisms of skin immune system support that are associated with the activity of the microorganisms. One of these is the colonization of the skin surface, preventing expansion by pathogens.

While a properly functioning microbiome of healthy skin supports the body’s immune barrier, its transition into a dysbiosis state may lead to numerous systemic disorders. Dysbiosis, which is a disturbance of the structural and functional balance of the normal microbiome, is caused by internal and external stressors. Factors used in the fight against dysbiosis and helping to restore the balance of the skin microbiota include the use of probiotics and prebiotics. Dysbiosis alters the proportions of organisms in the healthy skin microbiome and may trigger the pathogenic potential of the commensals. Examples of diseases associated with the skin microbiome composition disturbance include acne, atopic dermatitis (AD), and dandruff. *C. acnes* is, directly and indirectly, involved in the pathogenesis of the common inflammatory skin disease—acne vulgaris. The free fatty acids and the pro-inflammatory virulence factors—porphyrins, produced by these bacteria, can cause skin inflammation. *S. epidermidis*, which usually colonizes human skin without any negative health effects, can cause serious illness in some people. The pathogenic nature of *S. epidermidis* depends on the skin condition and the individual properties of the bacterial strain. In some AD (atopic dermatitis) patients, escalation of symptoms may be

due to increased *S. epidermidis* colonization. A similar correlation applies to *S. aureus*. However, it is necessary to clarify whether the over representation of *S. aureus* in AD is a cause or a consequence of inflammation. Moreover, *S. aureus*—considered a pathogenic species—may reside on the skin of approximately 10–20% of healthy people as a harmless commensal microbiome. Dandruff and seborrheic dermatitis are most commonly caused by *Malassezia* yeast, which are resident microbiota of healthy skin. It is observed in a research that the microbiome of patients with psoriasis contained a higher number of *Streptococcus* spp., *Malassezia* spp., and a relatively low number of *Cutibacterium*, compared to healthy individuals²⁴.

Skin as a Living Environment for Microorganisms

Since about 10% of exfoliated cells contain bacteria, this mechanism may significantly affect the microbiome composition. The thickness of the skin, the depth and location of the folds located on its surface, and the density of hair follicles and glands are all key factors that impact the host microbiome. Smaller or larger folds and natural depressions of the skin surface, such as the navel, offer a moist niche, separated from adverse environmental conditions, resulting in such areas being readily colonized by microorganisms. Additionally, the activity of sweat glands (eccrine and apocrine) and sebaceous glands can affect the appearance, or domination of particular microorganisms. The secretions released by glands affect microorganisms in different ways, creating conditions that stimulate or inhibit their development. Eccrine glands are responsible for the excretion of water and electrolytes and skin acidification, which prevents the colonization and development of microorganisms. In turn, the secretions of the apocrine glands, located in the axillary vault, are converted. Our skin has got microbes, If there is humid climate and heat, the microbial counts in the armpit and back and feet are increased by microorganisms to various substances that are responsible for the specific smell of sweat.²⁵

The eastern countries explain that everything that we apply on our skin brings about the microbial modification. There is symbiotic effect on what we apply on skin and the microbial colonies. If we apply antibacterial or artificially fragrant lotion on skin, the microbes may get negatively altered. In the eastern countries milk, oil is applied on skin which creates really a symbiotic effect. Instead of using anti-bacterial soaps if we apply milk or oil it will positively effect and enhance the microbial activity on the skin.

As per Ayurveda—In Ayurveda the sage Charakacharya has described regarding absorption of decoctions (herbs) used for treatment, used externally as well as internally ('BahyatahaAbhayantartahashcha') indicates the absorption of herbal potential through internal and external Agni²⁶. Hence there is similarity between eastern medicine and biomedicine about the pathway of microbes, such that internal herbs can be useful for internal microbes and externally used herbs can benefit external microbes.

In Ayurveda few treatment modalities on skin can be recognized like Abhyanga(oil massage), Upanaha(Poultice), Pradeha or Lepa(packs)etc. Which are found to be having great healing effects in relevance. The microbes on the skin convert the topically used material like into further digestible elements. Thus it can be inferred that there is digestive capacity (Agni) both inside in the gut and externally in the skin cells in the form of microbes.²⁷

3)Ayurveda Concept of Abhyanga (oil massage) and Concept about Essential oils and Microbes

These are not the nourishing kind of bioavailable unsaturated oils that are used in general sense for cooking etc. purposes, on contrary these represent the concentrated pharmaceutical grade specially prepared oils through process of distillation. These are antimicrobial and are actually

the distilled immune systems of plants. It protects the plants with its each drop. They have great potential to keep us healthy only if used in moderate amount. But if used more it can trigger the inflammatory reaction in the skin. It can hamper the beneficial microbe colony. The microbes which are commensal and are on skin they naturally form protective colony which acts as a barrier to invasions.

According to Ayurveda – The typical oils are used for Abhyanga (oil massage in Ayurveda) as per the different conditions/requirements of body (diseases). The oils like sesame and coconut etc they have potential to nourish the microbial colonies as they have the Manda Guna (Mild property)—As stated Shamane Manda (Palliative action by mildness), unlike the oils like eugenol (essential oil of Tulsi- *osimum sanctum*), which is Tikshna (Corrosive). As stated in Ayurveda Bhedane Tikshanah (breakage by corrosive action) as Tikshna attribute can cause breaking of bonds between commensal microbes. Also these essential oils can cause irritation if ingested as they are Ushna (hot) and ‘Daha Paak krut’ (cause burning and suppuration).

Armpit Transplant therapy

The healthy individual has less odor in armpit (axilla). More the bad odor more is the biodiversity of bad microbes.²⁸ There is a new concept of transplanting the armpit microbial community. In this transplant the bad odor giving microbes are transplanted by less odor giving good microbes.²⁹ This concept is appreciated as compared to the use of antiperspirants or deodorants because the antiperspirants or deodorants kill the good bacteria which is a dangerous side effect that enhances bad bacteria which can bring about inflammation in armpits. Ayurveda has got some remedy to remove foul smell with herbs- a research should be done whether these herbs actually removes the good bacteria's or only removes the foul smell). More research is needed to understand how the skin microbes play a role in various skin diseases and how the commensal microbes maintain the skin health.

As per Ayurveda -Ayurveda has mentioned various herbs for the external application in skin diseases as described in Kushtha treatment they are the various types of skin disorders. Research needs to be done on microbe level. That whether these Lepas remove the offender / pathogenic microbes and with this replacement it has the capacity to repair the inflammatory / diseased tissues. Also the *Shodhantaila* (detoxifying oil) recommended by Ayurveda, which is herbal formulation of processed oil, removes exudates from the suppurated wounds. So studies should be done in order to trace the microbial type which is present in suppurated wounds and which can be replaced by commensal microbes by Shodhan tail.

4) Ayurveda Concept of Anjana (Collyrium) and Microbes-

In a study, it was found that the most abundant phyla were represented by Proteobacteria (64%), Actinobacteria (19.6%), and Firmicutes (3.9%). The presumptive core of the conjunctival microbiota was formed of the following genera: *Pseudomonas*, *Propionibacterium*, *Bradyrhizobium*, *Corynebacterium*, *Acinetobacter*, *Brevundimonas*, *Staphylococci*, *Aquabacterium*, *Sphingomonas*, *Streptococcus*, *Streptophyta*, and *Methylobacterium*. The first five of these were the most stable presence of commensal bacteria at the ocular surface level has long been a subject of debate due to the constant washing by the tear film and to the antimicrobial nature of ocular secretions. However, clinical studies have indicated that fungal infections are correlated with the topical use of ophthalmic antibiotics, suggesting that the alteration of the positive interaction between the immune ocular system and microorganisms of the normal eye's bacterial flora exposes the eye to colonization by pathogens.³⁰

Using culture-based methods, it was observed that the ocular surface, as any other mucosal and cutaneous surface, shows an abundant microbial flora, consisting of Gram-positive and Gram-

negativemicroorganisms. The genera *Staphylococcus*, *Corynebacterium*, *Streptococcus*, *Propionibacterium*, and *Micrococcus* are commensal Gram-positive bacteria present in low numbers in the eyelids, conjunctiva, and tear film. These bacteria originate from the skin and colonize the ocular surface immediately after birth. This ecosystem remains relatively stable throughout life, unless it is altered by antibiotic treatment, surgical interventions, infections, or other problems (e.g., use of contact lenses in human medicine). Gram-negative bacteria, such as *Haemophiles*, *Pseudomonas*, and *Neisseria* genera, and fungi are less common, but they may be present in healthy individuals.³¹

As per Ayurveda -Some remedies are explained in Ayurveda like eye drops containing herb processed Ghee and Milk. These remedies increase threshold of commensal microbes and keep good practice in Ayurveda as remedy of commensal bacteria.

The use of molecular-based techniques, such as next-generation sequencing, allowed the discovery of a vast and diversified commensal bacterial flora that inhabits the human cornea and conjunctiva. The combination of these microorganisms constitutes a real microbiota capable of protecting the ocular surface from colonization by potentially pathogenic microbial species. The most represented bacteria of the ocular microbiota belong to the following genera: *Pseudomonas*, *Propionibacterium*, *Acinetobacter*, and *Corynebacterium*. However, this homeostatic microbiota can be easily altered by environmental factors, pathological states, such as dry eye syndrome, use of antibiotics, infections, such as blepharitis or conjunctivitis, and personal habits, such as excessive and irresponsible use of contact lenses, which may also represent a vehicle for infections by opportunistic pathogenic microorganisms. Therefore, the disruption of the normal eye microbiota can play a significant role as a cofactor in the pathogenesis of ophthalmic diseases. Furthermore, recent studies have also highlighted how the alteration of the microbiota of other body sites can favor the development of ophthalmic pathologies. Indeed, changes in the composition of the oral and intestinal microbiota have been associated with glaucoma, uveitis, and AMD, respectively. The study of the ocular microbiota is important to improve our knowledge of the role of homeostatic microorganisms in the prevention of several ophthalmic diseases and to develop new therapeutic strategies, based above all, on the intake of probiotics, for the treatment of ocular pathologies.

5) Dietetics in Ayurveda and eastern medicine and Microbes

Author Brigett Shea opines that the eastern people have such a lifestyle, which makes some microbial diversity and offers longevity of life. This lifestyle comprises of consistent movement breathing practice, meditation, herbal remedies and mild fasting etc, this ideal lifestyle is modern day human who has to abide by family and carrier.³² The modern medicine and lifestyle makes confusion in the natural intelligence of microbes. The natural intelligence of microbes recognizes potential threat and act upon them. This in her words the eastern medicine may not be a panacea, but offers a great insight which lacks in modern medicine. Shea has insisted that eastern medicine is design to support the body partly through the balancing of microbiom³³. It has un-wavering foundation and universal Lense through which the eastern medicine perceives reality.³⁴ Author is fascinated towards Indian specifically Hindu mythological culture. She praises the fasting i.e. called *Ekadashi* that comes twice in 1 month. Limited food is consumed on these two days makes the gut clean and maintains Gut integrity. On these 2 days regular grains in diet are given break and are not consumed this promotes gut health. Langhan should be done till we can get 4 score on Bristol stool chart. Author advice to consume different options that can work as digestion Perk-me-up. Some examples include a liquid combination of ginger, lemon and

himalayan rock salt or person with Phlegamy constitution can go for Trikatu all before 20 minutes of meal.

The author denies to eat the smoothies as it contains some added processed powder, they are cold, heavy and problematic to digest. One should not eat it on regular basis. Though she has not mentioned its connection with microbes it might be connected with the enhancement of gut flora. The monk Lama Lhanang Rinpoche also says that millions are living entities i.e. microbes are there in our body that are active during day time, and after afternoon their energy is waning thus heavy foods after the time of noons may become overburden for the microbes. This is a form of subtle violence to violate the natural laws, that, if followed will keep us and our little entities in a thriving state. If we follow the day and night cycle and sleep properly within time at night i.e. 10pm around the liver is on its detox mode, but if we fail to do so, the human as well as microbes body fails to go on detox mode.

This indicates that all these practices are closely related with enhancement of digestion and thereby good microbes enhancement in gut. The author recommends the principles of diet regulation method from Matrshitiya and Trividhakushiya concept from Ayurveda, which advises to fill the stomach with 80% with food she recommends 1/3rd food, 1/3rd water and 1/3rd empty.³⁵

6) Vyayam- Exercise and Human Gut Microbiota

In humans, a major study conducted on elite rugby players demonstrated that exercise enriched the diversity of gut microflora and positively correlated with protein intake and creatine kinase levels. In particular, there was a greater diversity among the Firmicutes phylum (such as *Faecalibacterium prausnitzii*) that helped to maintain a healthier intestinal environment. These results indicated that both diet and exercise determined the microbial biodiversity of the gut. In support of this, Estaki et al. analysed the faecal microbiota of individuals with different fitness levels and comparable diets. As an indicator of physical fitness, they used peak oxygen uptake, the gold standard of cardiorespiratory fitness (CRF). The results demonstrated that, regardless of diet, CRF was correlated with increased gut microbial diversity. Furthermore, fit individuals showed a microbiome enriched in butyrate-producing taxa, such as Clostridiales, Roseburia, Lachnospiraceae, and Erysipelotrichaceae, resulting in increased butyrate production, an indicator of gut health. Estaki et al. proposed that exercise could be used as a therapeutic support in the treatment of dysbiosis-associated diseases. Increased diversity is associated with increased health also in the elderly, while reduction of biodiversity is linked to different conditions such as obesity-associated inflammatory characteristics and gastrointestinal diseases (as IBD and IBS). Then the increase of microbial biodiversity related to the exercise could have beneficial effects on the pathogenesis of these conditions. Furthermore, since athletes show lower inflammatory and improved metabolic markers relative to controls, and the exercise is associated with reduced morbidity due to lower chronic inflammation, it is possible to hypothesize that age-appropriate exercise and diet could help to decrease inflammation and age-related pathologies. Moreover, compared with subjects with high BMI, subjects with low BMI and athletes show higher Akkermansia muciniphila levels in their microflora. These bacteria are mucin-degrading bacteria which reside in the mucus layer and they are inversely correlated with BMI, obesity, and metabolic disorders probably because they improve barrier function. Patients with ME/CFS showed a worsening of symptoms following exercise associated with intestinal dysbiosis. This could be due to increased intestinal permeability and increased bacterial translocation from the intestine into the bloodstream, resulting in further inflammation which, in turn, contributed to increase ME/CFS symptoms (such as pain, fatigue, and mood). In these patients, the

characterization of the gut microbiome demonstrated significant alterations compared with healthy controls with an increase of Firmicutes, particularly of *Clostridium* spp., in blood samples after exercise. In light of this, it was suggested that the recognition of changes in the intestinal microflora and bacterial translocation into the bloodstream in response to exercise could be a method to evaluate the effectiveness of treatments of these patients. Collectively, the available data strongly support that, in addition to other well-known internal and external factors, exercise appears to be an environmental factor that can determine changes in the qualitative and quantitative gut microbial composition with possible benefits for the host. In fact, stable and enriched microflora diversity is indispensable to the homeostasis and normal gut physiology contributing also to suitable signalling along the brain-gut axis and to the healthy status of the individual. Exercise is able to enrich the microflora diversity; to improve the Bacteroidetes-Firmicutes ratio which could potentially contribute to reducing weight, obesity-associated pathologies, and gastrointestinal disorders; to stimulate the proliferation of bacteria which can modulate mucosal immunity and improve barrier functions, resulting in reduction in the incidence of obesity and metabolic diseases; and to stimulate bacteria capable of producing substances that protect against gastrointestinal disorders and colon cancer (such as, SCFAs). Therefore, the exercise can be used as a treatment to maintain the balance of the microflora or to rebalance his eventual dysbiosis, thus obtaining an improvement of the health status. Nevertheless, further studies are needed to fully understand the mechanisms that determine changes in the composition and functions of the microflora caused by exercise and all their related effects. In addition, exercise-altered microbiota could be used to look for new approaches in the treatment of metabolic and inflammatory diseases in which it is well known that the microbiota plays an important role.

7) Ayurveda concept of Nidra (Sleep) and exercise and its effect on microbiom of gut-

Both sleep and exercise influence the gut microbiotic composition similar to the way bacteria is highly influenced by eating patterns and other Lifestyle factors in shaping metabolic and microbial functions.³⁶

Health of good bacteria also depends on Lifestyle factors other than food Host and microbiom. Both functions are impacted by light and dark cycle that is the sleep and wake cycle circadian rhythm govern the biological function irregular sleep pattern leads to diseases like diabetes and obesity etc developed in sleep. The jet lag or disturbed sleep pattern alters the microbes.

Much research conference that individuals' whose patterns frequently shift as due to chronic jet lag or working night shifts, they tend to have metabolic imbalances and increased weight gain interestingly it appears that disturb sleep patterns also significantly affect the good microbiota one study shows that transplanting cut microbes from chronically get like individuals into the Gastro intestinal tract of healthy my cost animals to develop metabolic this Regulation and weight again also.

Additionally decreased sleep quality also is found to influence the choices of food of an individual such person tends to choose gallery dense high fat food but unfortunately it will end use a state of disbiosis. Also the intestinal permeability is associated with this biosis which gets this intestinal permeability gets version by disrupt die urinal cycles results from animal studies conclude that it will only take three months of disturbance cycles to promote increased intestinal permeability.

The activity of intestine is regulated by circadian rhythms and it dictates the metabolic functions and nutrient absorption some research indicate that there are toll like receptors in the small intestine that may also follow a diagonal cycle this receptors are used by microbioms to

communicate with intestinal cells which helps in maintaining the normal pattern in various gastrointestinal functions.

As per Ayurveda – The improper sleep cycle is understood to be creating proneness to diseases. Keeping awake at night and overall less sleep is understood to considerably reduce the water content and unctousness in body, which is reflected on organ systems and senses level. That resembles dehydration symptoms. Whereas the oversleep and untimely sleep is understood to induce production of toxicity in gut such that the person deprives from freshness on level of senses, actions and digestion as well. Thereby the food choices, intestinal motility, metabolic function is challenged. Thus the disturbance in commensal microbes is apparent and pathogenic microbial rise can be assertive through the disease and symptoms promoted due to regular following of wrong sleep patterns.

Conclusion-

Above study reveals that Ayurveda advice the Dinacharya that is daily regimen which keeps a human healthy. After study of research papers on above tasks like strong collyrium and ghee drops, tooth brushing, mouth pulling, Udvartan (powder massage) etc, the middle connecting links between healthy status and the microbial flora enhancement becomes perceptible. The oil and unctuous substances like ghee may be working like the biofilm or substratum for commensal microbes to adhere and multiply. The alternate treatment like Udvartan which is dry may be removing pathogenic microbes from skin and also washing away excess pathogenic microbe and prevents dysbiosis. The Ayurved's advice to apply strong collyrium once in week in eyes in form of "Rasanjan" is utmost important. The Rasanjan generates lacrimation which may wash out some pathogenic microbes once in week. The eyedrops having ghee again creates substratum for growing of commensal microbes, this alternate chain of jobs of daily regimen has its natural intelligence which perfectly balances the microbial count and quality. The Ayurveda concept of diet which includes concept of Langhana (fasting) highly capacitates good microbial enhancement in the gut. The Sleep, exercise and following seasonal regimen are all the pillars of maintenance of microbial flora. Thus a deep understanding of microbes from biomedicine and its parallel Ayurved outlooks serves crucial to cater human requirements of healthy life.

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