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Review Article

The Science of Skin Hydration: Essential Ingredients for Dewy Skin

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ABSTRACT

Skin hydration refers to the process of maintaining an optimal level of moisture within the skin, which is essential for maintaining its health, elasticity, and overall appearance. Natural Moisturizing Factor (NMF) is the naturally occurring substance in stratum corneum which is responsible for skin hydration. Lamellar arrangement of inter-cellular lipids plays effective role of barrier against Trans epidermal water loss (TEWL). This review explores various classes of skin hydrating agents, including humectants, emollients, and occlusives, along with their mechanisms of action. Humectants, such as glycerine and hyaluronic acid, attract moisture to the skin, while emollients like natural oils and ceramides improve skin texture and barrier function. Occlusive agents, such as petrolatum and dimethicone, create a protective layer on the skin to minimize moisture evaporation. The efficacy of hydrating agents is influenced by factors such as personal care products, environmental conditions, excess water and skin type. Recent advancements and plant-derived extracts have further improved the performance of hydrating agents. This paper highlights the importance of selecting appropriate hydrating agents to maintain skin homeostasis and discusses emerging trends in skincare innovation.

INTRODUCTION

Skin hydration refers to the water content in the skin's outermost layer (stratum corneum). It helps maintain skin elasticity, smoothness, and overall health [1]. The skin plays a key role in preventing water loss. Water naturally evaporates from the outer layers of the skin into the air. To control this, the skin must keep its barrier strong. This is important because hydration affects how the skin looks, its flexibility, and how skin cells communicate. The skin's barrier can be weakened by harsh chemicals, rough treatment, dry air, and sun exposure. Many studies have explored how the outer skin layer works and why keeping it hydrated is essential.

Importance of Skin Hydration:

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- Maintains Skin Elasticity
- Prevent dryness and flakiness
- Enhances skin barrier function
- Promotes a healthy glow
- Reduces sensitivity
- Improves healing of skin

Composition Of Skin Barrier:

The skin is the largest organ in human body which comprises approximately 16% of body's weight and displays surface area estimated to be around $2m^2$. The skin's barrier can be weakened by harsh chemicals, rough treatment, dry air, and sun exposure. Many studies have explored how the outer skin layer works and why keeping it hydrated is essential (Castro et al., 2023).

Skin represents three distinct tissue layers:

⇒ Epidermis: Outermost layer
⇒ Dermis: Beneath the epidermal layer
⇒ Hypodermis: Deeper layer

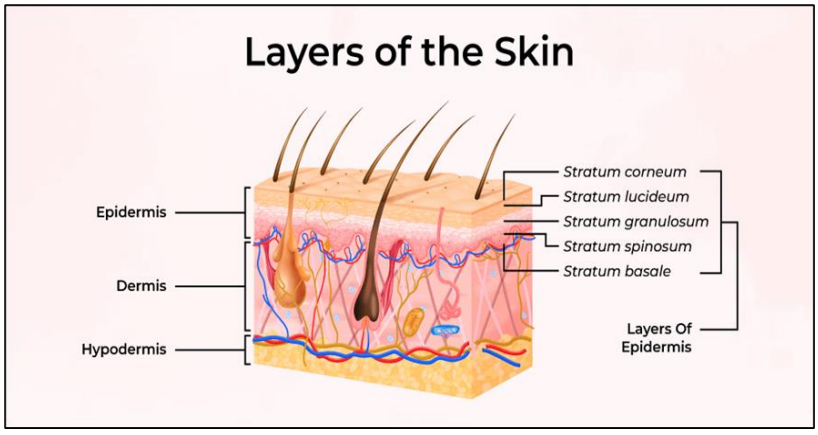

Fig No.1: Skin Layers

Functions Of Skin:

1. Protective shield
2. Barrier to water loss

3. Detoxification system
4. Temperature regulator
5. Wound repair
6. Early defence system

Mechanism Of Skin Hydration:

Epidermis:

The epidermis is the topmost layer of the skin and its main function is to form a barrier responsible for metabolising xenobiotics, as well as to promote the synthesis of melanin in melanocytes. Melanocytes are the cells responsible for skin pigmentation and sun protection (Nunes et al., 2017).

Epidermis consists of four different strata: -
Stratum corneum
Stratum granulosum
Stratum spinosum
Stratum Basale

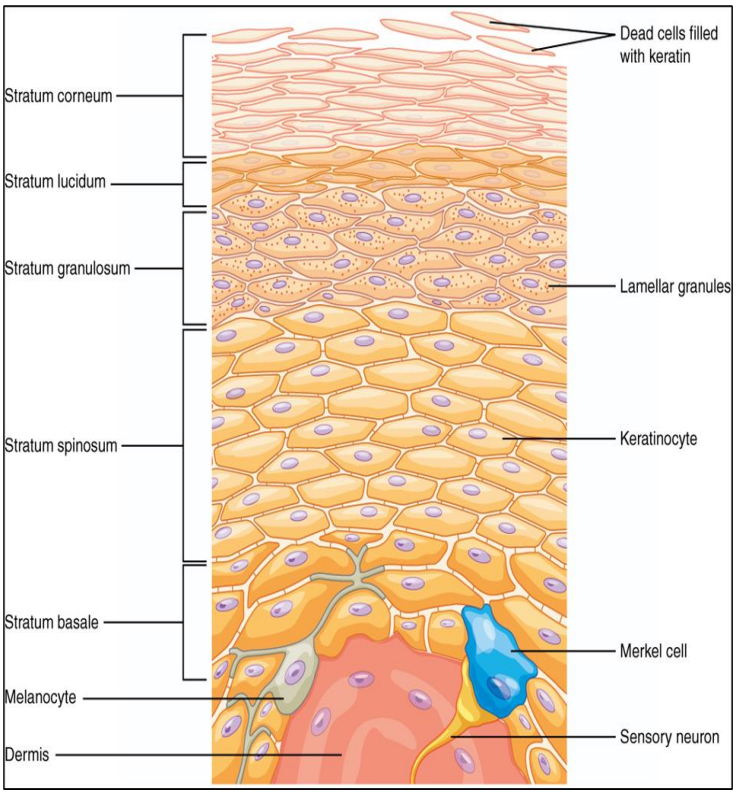

Fig No.2: Diagrammatic Representation of Epidermal Strata

Stratum Corneum:

The stratum corneum, the outermost layer of the epidermis, is typically 10 to 20 mm thick in most areas of the body. It is also known as 'Horny layer' which is made up of keratin filled dead corneocytes [2]. It consists of intercellular lipids and corneocytes, which are dead, flattened cells. Corneocytes have a hexagonal shape, contain keratin, and are enclosed by a protein-reinforced envelope made up of various proteins, including involucrin, loricrin, filaggrin, proline-rich proteins, and keratolinin [3]. Corneocytes originate from keratinocytes, the proliferative cells of the epidermis. As keratinocytes divide and migrate upwards through a process called differentiation, they undergo structural and biochemical changes. By the time they reach the stratum corneum, they lose their nuclei and organelles, transforming into protein-rich, flattened sacs. Although the stratum corneum is often considered a nonviable part of the epidermis, any disruption to this layer triggers a

series of responses in both the stratum corneum and the underlying viable epidermis, such as alterations in protease activity, lipid biosynthesis, aquaporin (AQP) function, and filaggrin expression [4]. Stratum corneum known as Brick-and-Mortar model. The rigid keratin filled corneocytes are the bricks and the intercellular lipids are the mortar. The intercellular lipids, along with lectins, desmosomes and corneodesmosomes, bind to corneocytes that help to hold them in place [5]. It is the physical arrangement of corneocytes and lipids which enables the skin to resist high trans epidermal water loss (TEWL). Desquamation: Desquamation or peeling skin is the shedding of dead cells from the outermost layer of skin. The entire process from cell birth to the "desquamation" of the corneocyte cells takes three to four weeks.

Fig No.3: Shedding Of Dead Skin Cells

Natural Moisturising Factor:

In addition to keratin, the stratum corneum contains a number of other hydrating agents known as natural moisturizing factor (NMF) [6]. The NMF constitute about 20% to 30% of dry weight of stratum corneum and are found intracellularly as well as extracellularly.

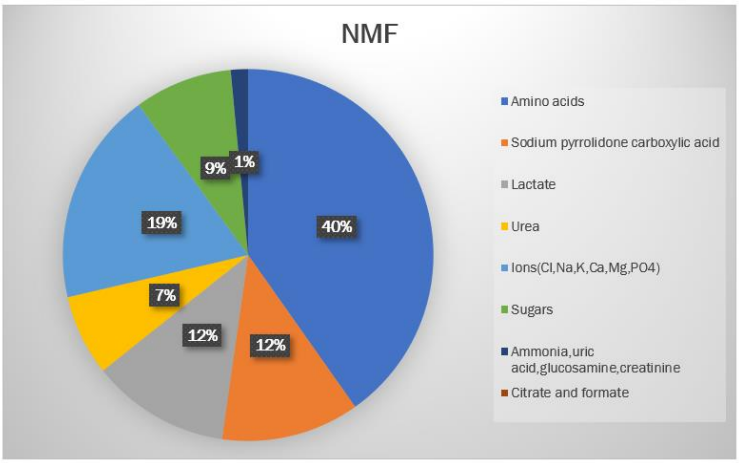

Fig No. 4: Composition Of Natural Moisturizing Factor

The NMF are effective humectants and their concentration varies as a function of age and skin depth [7]. Harding et al. report that for healthy skin not exposed to surfactant damage, the NMF content is independent of depth until one approach the filaggrin containing levels of the skin [8]. Filaggrin is a protein found in the stratum granulosum layer of the skin. It is derived from highly basic profilaggrin protein (found in keratohyalin granules of epidermis) which upon dephosphorylation yields filaggrin in uppermost layer of viable epidermis. Degradation of filaggrin into the components of NMF in stratum corneum maintains an adequate water supply when exposed to dry environments. Breakdown of filaggrin is controlled by water activity (0.7-0.95). When relative humidity is high, there in minimal breakdown of filaggrin. Drier conditions lead to increase in proteolytic activity, result in the production of more NMF. Thus, this mechanism

ensures adequate water content in the skin layer mostly influenced by change in environmental condition or chemical insult. As mentioned in above paragraph, NMF concentration varies as a function of age and skin depth. In the deeper stratum corneum layers of older individuals (50-65 years). NMF concentration is low due to diminished ability to degrade filaggrin. The high amount of NMF at the skin surface decreases as a function of depth.

Two additional NMF: - Hyaluronic acid and Glycerol are also found in stratum corneum.

- **Hyaluronic acid:**

The name of this polysaccharide is derived from Greek word '*Hyalos',* which means glass or vitreous, reflecting the origin of molecule. Hyaluronic acid is made up of repeating disaccharide units N-acetyl-D-glucosamine and D-glucuronic acid that are linked by glycosidic bond. It is a well-known component of dermis maintaining it's hydrated state and providing structural integrity. Hyaluronic acid function as a humectant as well it interacts with intercellular lipids and regulates mechanical properties of stratum corneum.

Table No.1: Example Of Tissue and Fluids Containing Ha

Structure of Organism	Concentration(µg/g)
Umbilical cord	4100
Synovial fluid	1400-3600
Dermis	200
Vitreous humour	140-338
Brain	35-115

Action Mechanism:

Hyaluronic acid is essential component of the extracellular matrix providing structural support to the skin. When this molecule reaches dermis, it stimulates production of collagen which is important for maintaining skin structure and elasticity. Due to its hygroscopic nature this polymer helps to retain water and favour collagen synthesis (Abatangelo et al., 2020; Becker et al., 2009).

HA Applications in Cosmetics:

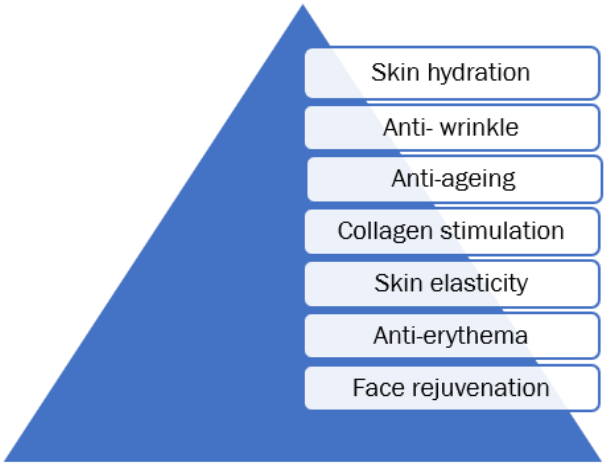

Fig No.5: HA Applications in Cosmetics

➢ **Glycerol:**

It is a breakdown product of sebaceous triglycerides or originate from conversion of phospholipids to free fatty acids. Like HA, glycerol also influences the skin's pliability by interacting with skin lipids. It's ability to modulate lipid organisation within stratum corneum further highlights its significance in skin barrier homeostasis.

➢ **Stratum Corneum Lipids:**

It plays major role in maintaining skin hydration. This intercellular lipid consists of approximately

1) Ceramides (40-50%)
2) Cholesterol (20-25%)
3) Fatty acids (chain length between 16 C to 30 C, most abundant)
4) Cholesterol sulphate (5-10%)

The approximate molar ratio of these lipids (Ceramide: Fatty acid: Cholesterol) is 1:1:1[9]. These intercellular lipids are arranged in highly organised Lamellar arrangement (bilayer) with only very small amount of water which plays role of effective barrier against TEWL. The ceramides are major components of the intercellular lipids, and this is reflected in their contribution to the structural organization of the lamellar bilayer. There are about nine major ceramides, which are synthesized from glucosylceramides, epidermosides (acyl glucosylceramides), and sphingomyelin [10]. Each ceramide contributes in specific ways to stratum corneum organization and cohesion and thus to the integrity of the barrier. The ceramide (CER)-naming nomenclature was proposed by Motta et al. [11]. Ceramides are designated as: CER FB, where F is the type of fatty acid and B is the type of base.

Table No.2: Designations Of Fatty Acids and Bases

Fatty acid(F)	(F) Designation	Bases(B)	(B)Designation
Normal fatty acid	N	Sphingosine	S
α-Hydroxy fatty acid	A	Phyto sphingosine	P
ω-Fatty acid	O	6- Hydroxy sphingosine	H
Ester-linked linoleic acid	E		

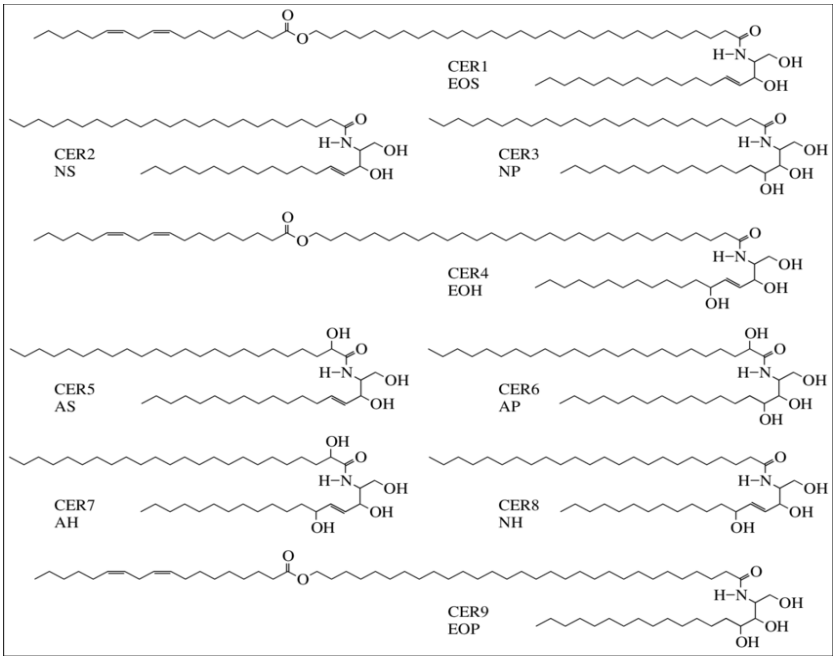

Fig No.6: Chemical Structure of Stratum Coneum Ceramide Lipids

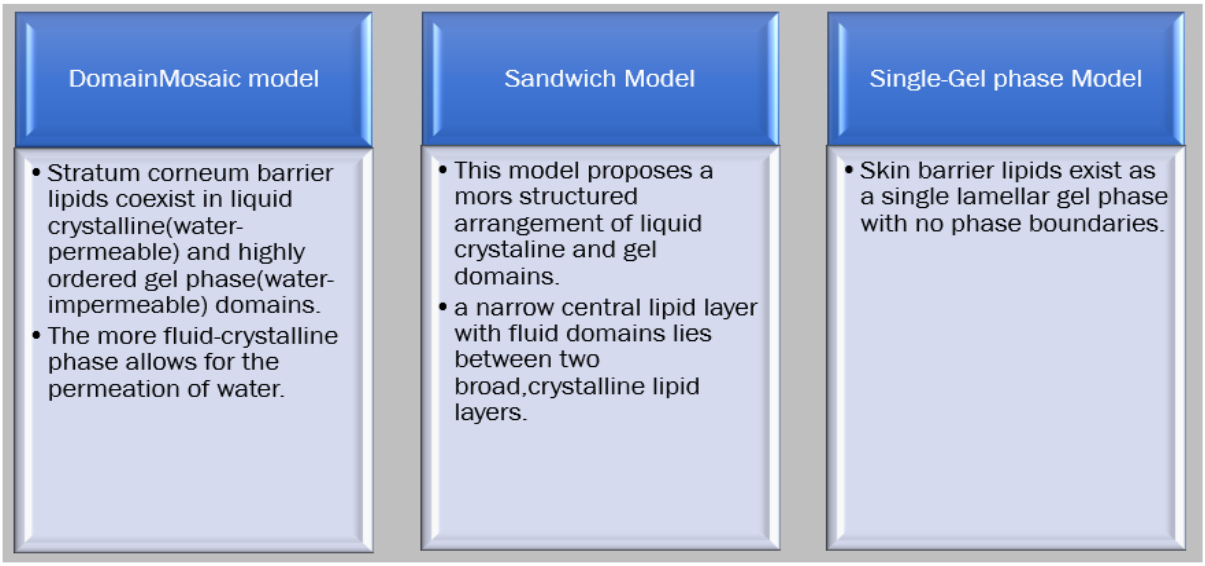

Fig No.7: Models Describing Barrier Lipids Structure Within Stratum Corneum [12]

➢ **Aquaporins And Tight Junctions:**

Another mechanism by which the skin maintains its hydrated state is the use of AQPs.

1. Role of aquaporins in skin hydration:

Aquaporins are transmembrane proteins that form water channels, allowing the transport of small polar molecules like water, glycerol, and urea across cell membranes [13].

2. Aquaporins in skin:

It is found in the basal and suprabasal layers of the epidermis but is not present in the outermost layer (stratum corneum). AQP3 facilitates the movement of water and glycerol, two key substances for skin hydration.

3. Effects of aquaporin deficiency:

Mice lacking AQP3 have skin that is less hydrated, less elastic, and has reduced permeability for water and glycerol. The skin also takes longer to recover from barrier damage. When glycerol is added, the skin condition improves, highlighting AQP3's role in hydration and elasticity [14].

Tight Junctions:

1. Tight junctions are made up of more than 40 proteins, including transmembrane proteins like claudins, occludin, and junctional adhesion molecules (JAMs), along with plaque proteins such as zonula occludens [15]
2. Claudins, occludins, and JAMs are primarily responsible for controlling water permeability within the skin. Claudin 1 is particularly critical for maintaining the integrity of the skin barrier. Tight junctions act as a physical barrier, making it difficult for water to pass through the space between epidermal cells.

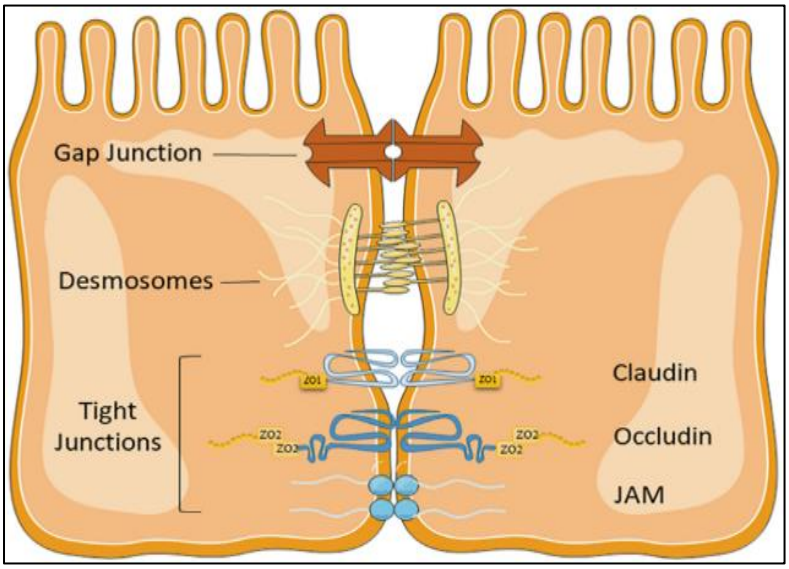

Fig No.8: Tight Junctions

Factors Affecting Skin Hydration:

❖ **Environmental Conditions:**

The environmental conditions around us significantly influence skin hydration, and this relationship is crucial for maintaining healthy skin. Several studies have shown how different factors such as relative humidity, temperature, and exposure to environmental insults affect skin's water content and overall barrier function. Here's a breakdown of the main findings:

1. Effect of Humidity on Skin Hydration

- **Low Humidity (less than 10%)**: Exposure to low humidity, even for short periods (3–6 hours), can decrease the water content in the skin's outer layer (stratum corneum), leading to dryness and increased skin roughness. This is because dry conditions inhibit corneodesmosomal degradation, which is necessary for skin to shed dead cells and maintain its integrity.
- **High Humidity (greater than 80%)**: Conversely, high humidity can also compromise the skin's hydration. Extended exposure to such conditions has been linked to a deterioration of the skin's barrier function and a decrease in Natural Moisturizing Factor (NMF) and corneocyte hydration. Interestingly, while dry conditions may trigger the skin to adapt by enhancing barrier function, high humidity tends to impair the skin's ability to respond effectively to environmental changes.

2. UV Radiation and Barrier Function

- **Excessive UV Exposure**: UV radiation from sunlight can cause erythema (skin redness) and damage the skin barrier. This increases the risk of water loss and dehydration in the skin, compromising its ability to maintain hydration.
- **Adaptation to Dry Climates**: Studies have shown that people living in hot, dry climates, like Arizona, have skin with better barrier function and less dryness compared to people in more humid environments like New York. The skin in arid climates seems to adapt by improving its ability to retain moisture and function optimally.

3. Environmental Transitions

- Abrupt transitions between dry and humid environments (e.g., from 80% relative humidity to less than 10%) can affect the skin's ability to adjust. In such cases, it may take a longer time for the skin barrier to recover. This slow recovery time can leave the skin vulnerable to damage during the adaptation period.

4. Vernix Caseosa and Foetal Skin

- The human foetus has an intriguing mechanism to protect its skin from the harmful effects of amniotic fluid. In the third trimester of pregnancy, the foetus's skin is coated by a biofilm called *vernix caseosa*, which serves as an effective barrier against fluid loss and microbial invasion. This biofilm, composed mainly of water, lipids, and proteins, resembles the structure of the skin's outer layers and aids in moisture regulation and protection. Interestingly, this feature plays a role in the skin's maturation and protection and is somewhat similar to the skin's natural barrier mechanisms that help maintain hydration later in life.

5. Environmental Impact on Skin's Lipid Biosynthesis and Barrier

- Changes in environmental conditions (like humidity) can alter lipid biosynthesis in the skin, which is critical for maintaining the skin's barrier function. Lipids in the stratum corneum act as a protective shield, preventing excessive water loss. Dehydrated conditions affect these lipids and inhibit the skin's ability to regenerate or repair its barrier efficiently.

❖ **Personal Skin Products and Skin Hydration:**

- Personal care products, especially cleansers, can have a significant impact on skin hydration. While cleansers are designed to remove dirt, oils, and impurities from the skin, the ingredients used in these products play a crucial role in preserving or compromising the skin's moisture barrier.
- The type of cleanser you use can significantly impact your skin's hydration levels. Cleansers are essential for removing dirt, oil, and other impurities from the skin, but their ingredients—especially surfactants—play a key role in whether your skin retains moisture or becomes dry and irritated. Here's an overview of how different types of cleansers affect skin hydration:

Table No.3: Effect Of Cleansers on Skin Hydration

Cleanser Type	Impact On Skin Hydration	Best For	Common Ingredients
Harsh Cleansers	Strips moisture, leads to dryness	Oil skin (used with caution)	Sodium lauryl sulphate, sodium Laureth sulphate and alkyl sulphate
Mild Cleansers	Maintains hydration, gentle on skin	Dry, sensitive, compromised skin	Non-ionic surfactants, amphoteric surfactants, mild alkyl sulphates (with ethoxylation), cocamidopropyl betaine, and disodium laureth sulfosuccinate
Emollient containing Cleansers	Provides moisture, supports barrier	Dry, sensitive or eczema prone skin	Oils (e.g., jojoba oil, argan oil), glycerine, shea

			butter, ceramides, and fatty alcohols.
Hydrating Cleansers	Draws moisture into the skin, plumps skin	Dehydrated, dry or ageing skin	Glycerine, hyaluronic acid, aloe vera, panthenol (vitamin B5), and sodium PCA.
Soap-free Cleansers	Gentle, maintains hydration	Sensitive, dry or irritated skin	Sodium cocoyl isethionate, sodium cocoyl glutamate, cocamidopropyl betaine, and surfactants derived from natural sources.
Oil Cleansers	Nourishes, locks moisture	Dry, mature or make-up wearing skin	jojoba oil, grapeseed oil, olive oil, and micellar water with oils.

❖ The Effects of Excess Water on Skin Hydration and Barrier Function:

1. Disruption of Skin Barrier Function

- Swelling and Increased Suppleness: Prolonged exposure to water causes the skin to swell, which increases its suppleness. This swelling can lead to structural changes in the SC, specifically weakening the cohesion between corneocytes (the cells in the outermost layer of the skin).
- Corneocyte Cohesion Weakening: The increased hydration disrupts the cohesion between corneocytes, which are typically held together by intercellular lipids. As the skin becomes overly hydrated, the structural integrity of these lipid layers is compromised, making it easier for substances, including water itself, to penetrate the skin. This can result in a compromised barrier function, making the skin more vulnerable to irritants and dehydration**.**

2. Increased Permeability

- Water Penetration: Excess water exposure increases the permeability of the SC. As the barrier lipids are disrupted, the skin becomes more permeable to water, which paradoxically leads to more moisture loss over time. This makes the skin more prone to trans-epidermal water loss (TEWL), a condition where water evaporates from the skin faster than it can be replenished, resulting in dryness and irritation.
- Vulnerability to External Agents: Along with increased permeability to water, the skin also becomes more susceptible to the penetration of other substances, including allergens, irritants, and bacteria. This weakened barrier can contribute to inflammation, dermatitis, and erythema (redness of the skin).

3. Structural Changes in the SC Lipid Layers

- Disruption of Lamellar Bilayer Ultrastructure: Studies, including those by Warner et al., have shown that overexposure to water disrupts the intercellular lamellar bilayer that forms the skin's lipid barrier. This lipid layer is crucial for maintaining the skin's barrier function, as it acts as a physical barrier to the external environment and helps in retaining moisture within the skin.

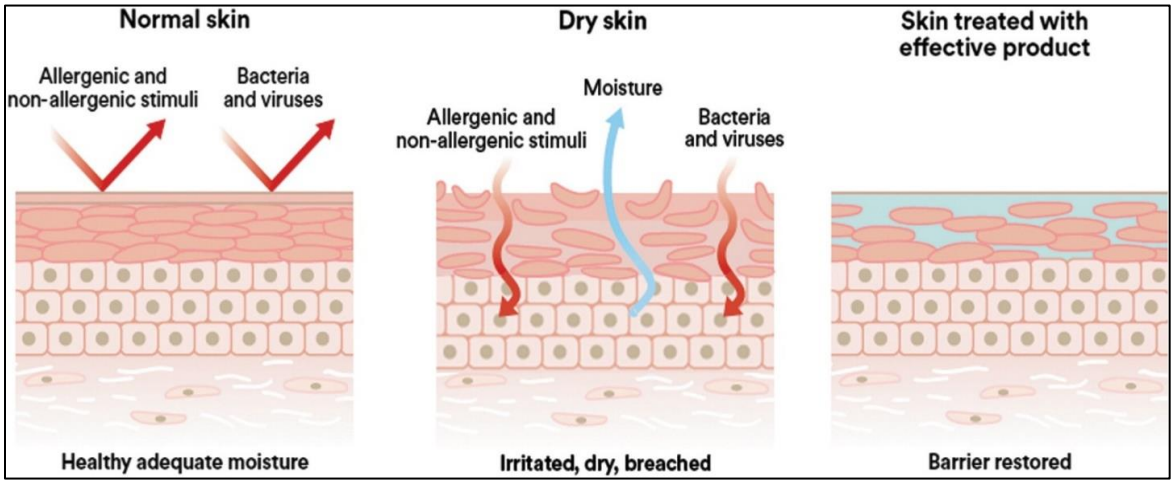

Fig No.9: Structural Changes in The Stratum Corneum Lipid Layer

❖ **Dietary Impact on Skin Hydration:**

1. **Water Balance in the Body**: Water constitutes a significant portion of our body, around 45% to 70%. This water is crucial for cellular functions, including those in the skin. The outermost layer of the skin, the stratum corneum (SC), plays a key role in water regulation, and maintaining its hydration is vital for smooth, healthy skin.
2. **Optimal SC Hydration**: Skin with an SC water content of around 20-30% appears soft and smooth. If hydration drops below 10-20%, the skin becomes dry and can suffer from rough texture or increased flakiness.
3. **Role of Mineral Water and Supplements**: Research shows that consuming mineral water can directly improve skin hydration. For instance, drinking 1 litre of mineral water daily for 42 days resulted in a 14% improvement in skin hydration, similar to the effects of topical moisturizers. Furthermore, supplements containing ingredients like vegetable ceramides, amino acids, and antioxidants have shown to enhance skin hydration and smoothness.
4. **Probiotics and Fatty Acids**: Certain dietary elements, like probiotics and omega-6 fatty acids (such as g-linolenic acid), improve skin barrier function. Studies have shown that regular consumption of these nutrients can reduce trans Refined Sugars epidermal water loss (TEWL) and enhance skin's natural hydration.

Impact of Dehydrating Foods and Habits:

- **Excessive Caffeine:**

Caffeine is a diuretic, meaning it increases urine production and can lead to dehydration if not balanced with enough water intake. This can contribute to dry, dull skin.

- **High-Sodium Diets:**

Too much salt in the diet can lead to water retention or dehydration. Excess sodium affects the skin’s ability to retain moisture, leading to dryness and puffiness.

- **Refined Sugars:**

High sugar intake can cause inflammation in the body, leading to impaired skin hydration. Sugars also contribute to glycation, a process where sugar molecules attach to collagen and elastin, making the skin less elastic and more prone to dryness and wrinkles**.**

- **Alcohol:**

Alcohol is also a diuretic, and drinking alcohol without compensating for the lost fluids can result in dehydrated, dry skin.

Hydrating Substances:

Table No.4: Common Moisturizers

Moisturizer class	Examples
Humectants	Glycerine, gelatine, propylene glycol, Butylene glycol, panthenol, sorbitol, urea, hyaluronic acid, glycolic acid, lactic acid and sodium pyrrolidine carboxylic acid
Emollients	Cholesterol, squalene, linoleic acid, stearic acid, oleic acid and fatty alcohols
Occludent	White soft paraffin/ petrolatum, beeswax, mineral oil, dimethicone, lanolin, carnauba wax, cetyl alcohol and caprylic triglyceride

1) Hyaluronic Acid:

Hyaluronic acid is a naturally occurring substance in the body that is known for its ability to retain moisture. However, in its natural form, HA is highly susceptible to degradation by the enzyme **hyaluronidase**, which breaks down its chemical bonds. This breakdown reduces its biological activity and effectiveness in cosmetic products.

Modifications for Enhanced Use:

To address this challenge, chemical modifications are often made to HA before it can be effectively used in cosmetic and pharmaceutical formulations:

1. **Reduction of Hydrophilic Nature**: HA is highly hydrophilic, meaning it attracts water. In order to make it compatible with other ingredients in formulations, such as hydrophobic (water-repelling) components, its hydrophilic properties may be modified.
2. **Cross-linking**: HA can be chemically modified to form cross-linked structures, turning it into insoluble derivatives or hydrogels. These modifications improve the stability and long-lasting properties of HA in products.
3. **Sodium Hyaluronate (NaHA)**: A modified, more stable form of HA, NaHA is commonly used in cosmetic formulations. It is the salt form of hyaluronic acid, which is more stable and less prone to degradation.

Use of HA and NaHA in Cosmetic Products:

1. Concentration in Products: Both HA and NaHA are used in cosmetic formulations, typically at concentrations ranging from 0.2% to 1% for HA, and up to 2% for NaHA [16]
2. Products Containing HA/NaHA: These ingredients are commonly found in products like creams, lotions, serums, masks, and other dermatological preparations. These products aim to enhance skin hydration, texture, and overall appearance.

Market Trends:

1. Prevalence of NaHA: Despite HA's known benefits, sodium hyaluronate dominates the market, being present in over 95% of products, while HA itself accounts for only about 5% [17].
2. Market Growth: The market for hyaluronic acid-based beauty products was valued at $2.1 billion in 2022, with projections indicating it could grow to $4.0 billion by 2031. This growth is attributed to several factors:
   - The increasing prevalence of dermatological issues like dryness and aging.
   - Growing demand for affordable, effective skincare product.

Table No.5: Skin Hydration Cosmetic Products Containing Ha [18]

Products	Brand Name	Dosage form	HA form
Skin Ceuticals Hydrating B5	Skin Ceuticals (EUA)	Serum	NaHA
Vicky Minéral 89	Vicky (France)	Serum	NaHA
L'Oréal Paris Hydra Filling Night Cream	L'Oréal Paris (France)	Cream	NaHA
Neutrogena Hydro Boost Cream	Neutrogena (EUA)	Cream	NaHA
Croma-Pharma Farewell Dry Skin	Croma-Pharma (Austria)	Serum	HMW-HA and LMW-HA
Biohyalux HA Hydro Intense Serum	Biohyalux (China)	Serum	Four different molecular weights of HA

2) Ceramides:

Ceramides (CERs) are a class of sphingolipids, which are lipids composed of a fatty acid (FA) conjugated with a sphingoid base (SB) through an amide bond. These molecules play a crucial role in maintaining the skin's integrity and hydration by forming part of the stratum corneum, the outermost layer of the skin.

Structure of Ceramides:

The basic structure of ceramides consists of two key components:

1. Fatty Acid (FA): This is a long-chain fatty acid that is attached to the sphingoid base.

2. Sphingoid Base (SB): This is a long-chain amino alcohol, which forms the backbone of the ceramide molecule.

Together, these components form a highly ordered lamellar structure in the skin that is essential for:

- Maintaining the skin's barrier function, preventing the loss of water (trans-epidermal water loss, or TEWL).
- Preventing environmental damage from harmful substances and microorganisms.

Ceramides are one of the main lipid components in the epidermis, accounting for a significant portion of the stratum corneum. They help maintain homeostasis by:

- Forming a protective barrier that locks in moisture and protects against dehydration.
- Maintaining the skin's integrity by stabilizing the skin structure and allowing it to recover from external damage.

Table No.6: Skin Hydration Cosmetics Containing Ceramides.[19]

Products	Brand Names	Dosage Form	Types Of Ceramides
CeraVe Facial Moisturising Lotion	CeraVe (USA)	Lotion	Ceramide NP, Ceramide AP and Ceramide EOP

CeraVe Facial Moisturising Lotion	La Roche Posay (France)	Cream	Ceramide 3
CeraVe Facial Moisturising Lotion	Eucerin (Germany)	Cream	Ceramide NP
L'Oréal Paris Revitalift Filler	L'Oréal Paris (France)	Cream	Ceramide 5, Ceramide 3 and Ceramide R
Dr. Jart+ Ceramidin Liquid Holika Holika Good Cera	Dr. Jart+ (South Korea)	Facial Toner	Ceramide NP, Ceramide AP, Ceramide AS, Ceramide NS and Ceramide EOP
Holika Holika Good Cera	Holika Holika (South Korea)	Cream	Ceramide NP

3) Butylene Glycol:

Butylene glycol acts as humectant, attracts and retains moisture. It pulls moisture from air into the skin. It also acts as penetration enhancer. It is a non-greasy hydrating agent which provides lightweight moisture, ideal for oil or acne prone skin.

4) Glycerine:

It is a powerful humectant. It forms a protective layer that locks in hydration. Th soothe dry and irritated skin and helps in reducing redness, flakiness and irritation.

Table No.7: Comparison Of Glycerine and Butylene Glycol

Property	Glycerin	Butylene Glycol
Type of hydration	Deep, long-lasting hydration	Light-weight, quick absorbing
Texture	Thick, slightly sticky	Thin, silky, non-sticky
Besst for	Dry, dehydrated skin	Oily, combination skin
Extra benefits	Strengthens skin barrier	Enhances penetration of other ingredients

5) Lactic Acid:

It acts as a exfoliant and peeling agent to remove dead skin cells and improves skin texture. Lactic acid has been found to stimulate ceramide synthesis, which contributes to a healthier skin barrier. At higher concentration it increases skin plasticity, which is beneficial for improving skin flexibility and texture.

6) Sorbitol:

Sorbitol acts as a mild humectant, adds hydration without greasy feel. Its hygroscopic properties are reported to be inferior to that of glycerine. When ingested in large amounts(>20g/day), it often produces a laxative effect.

Skin Hydrating Products Based on Skin Type:

Table No.8: Skin Hydrating Products Based on Skin Type

Skin Type	Hydrating Ingredient	Brand Name
Dry skin	Hyaluronic acid, glycerine, ceramides, shea butter	CeraVe Moisturizing Cream Neutrogena Hydro Boost Water Gel

		□ La Roche-Posay Lipikar Balm AP+ □ Aveeno Daily Moisturizing Lotion
Oil skin	Hyaluronic acid, Niacinamide, Aloe Vera	□ Neutrogena Hydro Boost Water Gel □ Plum Green Tea Oil-Free Moisturizer □ Minimalist 10% Niacinamide Moisturizer □ Cetaphil Oil-Free Hydrating Lotion
Combination skin	Hyaluronic acid, Niacinamide, squalane	□ Clinique Moisture Surge □ Simple Hydrating Light Moisturizer □ The Ordinary Natural Moisturizing Factors + HA □ Bio derma Hydrabio Gel-Crème
Sensitive skin	Aloe Vera, Centella Asiatica, Glycerine, Ceramides	□ CeraVe Daily Moisturizing Lotion □ Aveeno Ultra-Calming Daily Moisturizer □ Bio derma Sensibio Light Cream □ Avene Skin Recovery Cream
Acne-prone skin	Niacinamide, Aloe Vera, Green tea, squalane	□ Plum Green Tea Oil-Free Moisturizer □ La Roche-Posay Effaclar Mat Moisturizer □ Minimalist Sepicalm 3% Moisturizer □ COSRX Oil-Free Ultra-Moisturizing Lotion

Fig No.10: Different Types of Skin

Natural Agents of Plant Origin:

Vitis Vinifera (L):

Vitis vinifera (L), also known as grapevine or vine, is a plant belonging to the genus Vitis, of the Vitaceae family. Grapes have numerous health benefits due to their constitution, which includes various bioactive compounds such as proanthocyanidins, anthocyanins, flavonoids, phenolic acids and stilbenes [20]. The concentrations of these phenolic compounds can vary depending on the morphological part of the plant in question, from the stem to the seeds [21]. Vitis vinifera (L), commonly known as grapevine, is used in moisturizing cosmetics due to its bioactive compounds that enhance skin hydration. These compounds improve water retention, support the skin's barrier function, and increase the expression of aquaporins, crucial proteins responsible for water transport in skin cells. The

antioxidants in Vitis vinifera, such as resveratrol and flavonoids, protect against oxidative stress caused by external factors like UV radiation, thus preserving collagen, elastin fibres, and hydration. In addition to phenolic compounds, grape seeds are rich in unsaturated fatty acids, particularly linoleic and oleic acids, which are essential for maintaining the skin's barrier function. A deficiency in these fatty acids can impair the barrier and contribute to water loss and dehydration. Grape seed oil helps replenish these fatty acids, supporting the skin's function. Furthermore, polyphenols in Vitis vinifera, especially proanthocyanidins, can increase the expression of aquaporin-3 in skin cells, promoting hydration throughout the skin layers.

Table No.9: Grape Based Moisturising Products [22]

Product	Brand	Dosage form	Ingredients
Caudalie Vinosource-Hydra	Caudalie (France)	Cream	Grape water, grape seed oil, grape seed extract and grape juice
HydraVine Chardonnay Grape Mask	TheraVine (South Africa)	Face mask	Grape seed extract
Biolaven Day Face Cream	Biolaven (Poland)	Cream	Grape seed oil
Korres Body Smoothing Milk	Korres (Greece)	Body milk	Grape fruit extract
DieNikolai Grapeseed Oil Darling	DieNikolai (Austria)	Cream	Grape seed oil and grape skin extract
Dvine Grape Power Dynamic Day Cream	Dvine (Portugal)	Cream	Grape fruit water and grape seed oil

Rafique et al. conducted a study to evaluate the effectiveness of a topical water-in-oil (W/O) emulsion containing 3% grape seed extract from *Vitis vinifera* (L) compared to a placebo. The study concluded that the grape seed extract cream could be a potential moisturizing and anti-aging agent. Sharif et al. conducted a single-blinded randomized study to evaluate the effects of a water-in-oil (W/O) emulsion containing 2% Muscat hamburg grape seed extract, a red grape variety of *Vitis vinifera* (L), compared to a placebo. The results showed that the emulsion reduced melanin content, sebum, and erythema, while increasing skin elasticity. The study concluded that the formulation exhibited antioxidant properties, acted as a natural skin whitener, moisturized the skin, and had potential anti-a ging effects due to increased skin elasticity.

Algae:

Algae, particularly marine algae, have gained attention in skincare due to their impressive hydrating properties. They contain polysaccharides, such as alginates and carrageenans, that form a protective layer on the skin, preventing moisture loss while improving the skin's hydration levels. Additionally, algae have the ability to stimulate the production of skin-replenishing compounds like hyaluronic acid, further supporting long-lasting hydration. Normally, polysaccharides extracted from algae, especially green seaweed, have a slower rate of moisture absorption compared to glycerine, a widely used humectant.

Table No.10: Algae Based Moisurizing Agents [23]

Product	Brand Name	Dosage form	Ingredients
Nuxe Crème Fraîche de Beauté	Nuxe (France)	Cream	Red algae extract
Lierac The Moisturizing Lotion	Lierac (France)	Lotion	Green and brown algae
SkinCeuticals Daily Moisture	SkinCeuticals (USA)	Cream	Red and brown algae extract
Crème de La Mer	La Mer (USA)	Cream	Brown algae extract

Natural Remedies:

1. **Aloe Vera:**

Aloe Vera it is rich in water, anti-oxidants and vitamins that helps lock moisture and promote healing.

2. **Coconut Oil:**

Natural emollient that traps moisture in the skin and helps repair the skin barrier.

3. **Honey:**

Natural humectant, draws moisture from the environment into the skin. Great for sensitive or irritated skin.

4. **Olive Oil:**

Rich in fatty acid and anti-oxidant which helps to hydrate and protect skin and also helps soothe dry and flaky skin.

5. **Avocado:**

Deeply nourish and hydrate the skin. Beneficial for dry or mature skin.

6. **Rose Water:**

Hydrating, soothing and anti-inflammatory properties, making it perfect for sensitive or dry skin.

7. **Cucumber:**

High water content and it is known for its cooling and hydrating properties, ideal for dehydrated skin.

8. **Jojoba Oil:**

Similar to skins natural serum making it easily absorb. It helps to balance oil production while providing deep moisture.

Recent Advancements:

Recent advancements in skin hydration technologies have introduced innovative methods and ingredients to enhance skin moisture retention and overall health. Notable developments include:

1. **Skin Flooding Technique:** Originating from K-beauty practices, skin flooding involves layering multiple skincare products on moist skin to lock in hydration and prevent water loss. Starting with damp skin, products are applied in succession to create a “flooded” effect, resulting in plump and hydrated skin. E.g. Croda beauty
2. **Jellyfish Mucin in Skincare:** Derived from jellyfish secretions, jellyfish mucin is rich in glycoproteins, peptides, and amino acids. It offers hydration, supports the skin barrier, and improves elasticity. Incorporating this ingredient has shown positive effects on skin hydration and smoothness. E.g. JM solution Active Jellyfish Vital Mask.
3. **HydraFacial:** A multi-step treatment that deeply cleanses, exfoliates, and hydrates the skin with serums containing hyaluronic acid, antioxidants, and peptides. Suitable for acne-prone skin as it unclogs pores while hydrating.
4. **Mesotherapy:** Microinjections of hyaluronic acid, vitamins, and peptides to hydrate and rejuvenate the skin. Helps with scarring and dryness, improving overall skin texture.

5. **Profhilo (Injectable Moisturizer):** A stabilized hyaluronic acid injection that spreads beneath the skin, improving hydration and elasticity. Non-comedogenic, making it good for acne-prone skin.
6. **PRP (Platelet-Rich Plasma) Therapy:** Uses your own blood's growth factors to stimulate collagen and enhance skin hydration. Can also help with acne scars.
7. **Skin Boosters:** Microinjections of lightweight hyaluronic acid fillers to deeply hydrate the skin over time. Gives a long-lasting glow and improves skin resilience.
8. **Regenerative Hydrogels for Skin Treatment:** Regenerative hydrogels, composed mainly of water-absorbing polymers, are utilized in wound healing. They create a moist environment that accelerates tissue regeneration and provides sustained hydration to the affected area.
9. **Sustainable Activated Silk™ Peptides:** Evolved by Nature has introduced Activated Silk™ peptides, eco-friendly alternatives to traditional synthetic peptides. Derived from discarded silk cocoons, these peptides provide bioactive properties for skincare products, promoting skin health while reducing environmental impact.

Life-Style Changes:

Fig No.11: Life-Style Changes

CONCLUSION:

Skin hydrating agents play a crucial role in maintaining skin health by improving moisture retention, enhancing skin barrier function, and promoting overall skin appearance. Various hydrating agents, including humectants, emollients, and occlusives, work synergistically to optimize skin hydration. Humectants like hyaluronic acid attract water to the skin, emollients such as ceramides smooth and soften the skin, while occlusives like petrolatum form a protective barrier to prevent moisture loss. The selection of appropriate hydrating agents depends on individual skin types, environmental factors, and specific skin concerns. Regular use of hydrating agents not only improves skin elasticity and texture but also helps prevent dryness, irritation, and premature aging. Further research into novel hydrating ingredients and advanced delivery systems can enhance the efficacy and sustainability of skincare formulations. In

conclusion, incorporating scientifically proven hydrating agents into daily skincare routines is essential for maintaining optimal skin hydration, improving skin health, and promoting overall dermatological well-being.

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