INGREDIENT

innovation
by pHformula **FOCUS**

SOS peel-off mask

SOS peel-off mask

pHformula is proud to introduce the new SOS peel-off mask with sucrose and algin base. It has triple red fruit power that is not only focused on the soothing effects of cranberry, but also adding the benefits of strawberry and raspberry.

SOS: save our skin with triple skin soothing, hydration, and antioxidant power. It leaves the skin feeling refreshed, calm and glowing.

PEEL-OFF MASK: translucent alginate and sucrose mask offering skin softness and comfort while aiding the absorption of active ingredients.

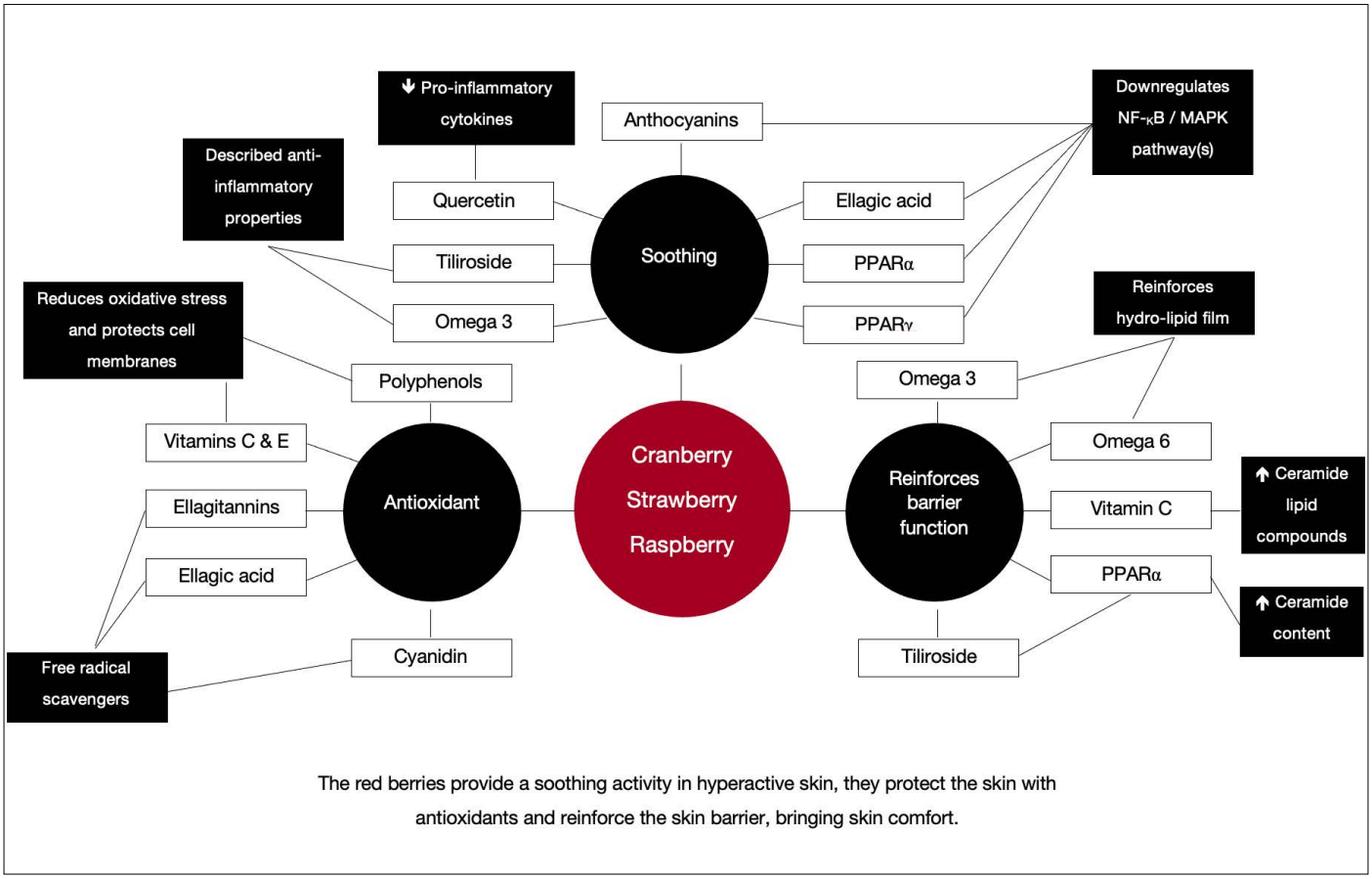
SOS peel-off mask skin benefits:

- Triple skin soothing effect.
  - The synergy between cranberry, strawberry, and raspberry leaves the skin calm and refreshed.
- Provides skin comfort.
  - Triple barrier reinforcement.
  - Triple antioxidant protection.
  - 5-fold hydration power.
- Age-reducing signs action.
  - Promotes collagen synthesis, helps to reduce collagenase and contributes to reduce skin roughness and wrinkle depth.
- Skin brightening effect.
  - Quenching of copper ions that reduces tyrosinase activity as well as vitamin C that has a skin brightening effect.

Translucent, alginate peel-off mask with cranberry, strawberry, and raspberry.

Peel-off mask properties:
Peel-off masks should be used after applying a serum. Peel-off masks acts like an occlusive shield, allowing active ingredients to deeply penetrate into the skin. Alginate mask is composed of sucrose, algin, and calcium sulphate and it provides a refreshing, soothing skin treatment. (Information provided by raw material supplier).

Summary



The red berries provide a soothing activity in hyperactive skin, they protect the skin with antioxidants and reinforce the skin barrier, bringing skin comfort.

	Cranberry	Strawberry	Raspberry
Soothing	• Anthocyanins (downregulates NF-$_{K}$B & MAPK signalling pathways). • Quercetin (reduces the production of pro-inflammatory cytokines). • Omega 3 fatty acids (described anti-inflammatory properties).	• Polyphenolic compounds such as tiliroside (documented anti-inflammatory activity). • PPARα agonists and PPARγ ligands (downregulates NF-$_{K}$B pathway). • Ellagic acid (downregulates NF-$_{K}$B pathway).	• Anthocyanins (downregulates NF-$_{K}$B & MAPK signalling pathways). • Quercetin (reduces the production of pro-inflammatory cytokines). • Omega 3 fatty acids (described anti-inflammatory properties).
Barrier	• Omega 3 and 6 fatty acids (reinforces the hydrolipidic film). • Vitamin C (stimulates the synthesis of ceramide-lipid compounds).	• PPARα (increase ceramide content by stimulating the expression of ceramide-related enzymes). • Tiliroside (enhances the expression of PPARα).	• Omega 3 fatty acids (reinforces the hydrolipidic film). • Vitamin C (stimulates the synthesis of ceramide-lipid compounds).
Antioxidant	• Polyphenols (flavonoids, phenolic acids, proanthocyanidins), tocotrienols (vitamin E), vitamin C (reduce oxidative stress, protect cell membranes).	• Ellagitannins and ellagic acid (scavenges free radicals).	• Cyanidin and ellagic acid (free radical scavengers).

Properties

Available from September-October 2024

INCI:
Sucrose, Calcium Sulfate Hydrate, Algin, Vaccinium Macrocarpon (Cranberry) fruit powder, Fragaria Vesca (Strawberry) seed, Parfum (fragrance), Magnesium Oxide, Xanthan Gum, Tetrasodium Pyrophosphate, Hydrated Silica, Rubus Idaeus (Raspberry) seed powder, CI 17200 (Redd 33 Lake)

Innovation: SOS peel-off mask

KEY INGREDIENTS

- Cranberry
- Strawberry
- Raspberry
- Algin
- Sucrose

INDICATIONS

- Recommended for all skin types
- Fitzpatrick I – VI

DIRECTIONS FOR USE

For the face:

Measure 50mg (1 scoop + almost ⅔ scoop) of the powder into a mixing bowl and add 40ml cold water. Stir vigorously with a spatula until a soft gel texture forms. Apply immediately to the face. Peel off after 15 minutes in one piece.

For the face and neck:

Measure 65mg (2 scoops + almost ⅛ scoop) of the powder into a mixing bowl and add 50ml cold water. Stir vigorously with a spatula until a soft gel texture forms. Apply immediately to the face and neck. Peel off after 15 minutes in one piece.

PROFESSIONAL USE ONLY.

Benefits

Benefits:

- Triple skin soothing effect.
  - The synergy between cranberry, strawberry, and raspberry leaves the skin feeling calm and refreshed.
- Provides comfort to the skin.
  - Triple barrier reinforcement.
    - A combination of sources (omega 3 and 6, vitamin C, tiliroside and PPARα) from the red berries help to reinforce the hydrolipidic film and increase ceramide content by stimulating the expression of ceramide-related enzymes, as well as the synthesis of ceramide-lipid compounds).
  - Triple antioxidant protection.
    - Various compounds from the red berries offer powerful free radical scavenging action, reduce oxidative stress, and protect cell membranes from lipid peroxidation.
  - 5-fold hydration power.
    - The combination of cranberry, strawberry, raspberry, with algin and sucrose offers enhanced hydration, reducing trans epidermal water loss.
- Age-reducing signs action.
  - Promotes collagen synthesis, helps to reduce collagenase and contributes to reduce skin roughness and wrinkle depth.
- Skin brightening effect.
  - Quenching of copper ions that reduces tyrosinase activity as well as vitamin C that has a skin brightening effect.

Comparison

SOS peel-off mask (previous formulation)	SOS peel-off mask (new formulation)
	
200g	300g powder in a 500ml jar
• Cranberry seed extract. • Talc, glucose, and algin base. • Benefits: – Soothing and calming – Strengthening skin barrier – Helps prevent water loss – Antioxidant activity – Age-reducing signs action – Skin brightening effect with skin glow – Immediate cooling effect – Easy application	• Triple berry power. • Talc free with a sucrose and algin base. • Benefits: – Triple skin soothing effect. Provides a calming effect – Triple barrier protection – 5-Fold hydration power – Triple antioxidant activity – Age-reducing signs action – Skin brightening effect with skin glow – Immediate cooling effect – Easy application and removal – Great texture and sensorial experience – Skin looks calm and supple

Comparison

SOS peel-off mask	SOS repair mask	H.Y.D.R.A. gel mask	P.E.P.T.I.D.E. powder	A.D.V.A.N.C.E.D. peel-off mask
				
Immediate soothing and comfort. “Fire extinguisher”	Immediate relief & repair. “Ambulance”	Refreshes and moisturises the skin. “Budget friendly hydration”	Smooths and firms the skin. “Skin iron”	Antipollution skin detox mask. “Skin detox mask”
Soothing action. Brings skin comfort to sensitised and reactive skin.	A mask infused with serum. Repairing and antioxidant properties.	More affordable than peel-off masks.	Age-reducing mask. Immediate firming effects promoting a visibly healthier complexion.	Removes pollution from the skin. Helps purify, soothe, and balance the skin.
Reinforces the skin barrier and locks in moisture.	Soothing and repairing. For acne-prone, sensitised and discomfort skin.	Refreshing, moisturising, and calming gel mask.	Smooths the skin micro-relief. Accelerates cell renewal for a fresher, more vibrant complexion.	Cooling and calming. Provides decongestion and smoothness.
Protects the skin with powerful antioxidant properties.	Ideal after advanced treatment procedures such as level 3, Needling, IPL, Laser and waxing.	Can be placed in the fridge for increased cooling. Can be used as a conductive gel for Radio Frequency.	Re-densifies wrinkles. Improves the appearance of dynamic facial wrinkles and loss of firmness on neck and décolleté.	Antioxidant and moisturising properties.

Cranberry fruit powder

What is Cranberry fruit powder?

Vaccinium macrocarpon (cranberry) fruit powder is extracted from dried cranberry pulp. It possesses polyphenols and tocotrienols that provides powerful age-reducing signs effect, while omega-3 and -6 fatty acids reinforces the skin hydrolipidic film. It also offers antimicrobial and protecting properties. (Information provided by raw material supplier).

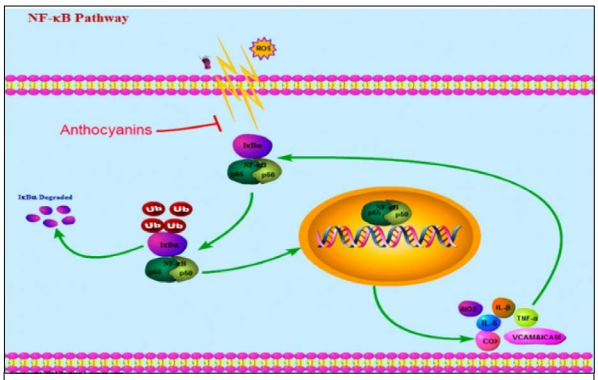
Cranberries are a good source of various vitamins, particularly vitamin C which is known for its antioxidant properties. Other vitamins present in cranberries are vitamin E, K, A, and B complex including B^1, B^2, B^3, B^5, B^6, and B^9 which collectively support energy metabolism, cellular processes and overall health. Cranberries contain several essential minerals like potassium, manganese, copper, calcium and magnesium as well as phytochemicals and antioxidants such as flavonoids (quercetin and kaempferol with antioxidant and anti-inflammatory properties), phenolic acids (ellagic acid and hydroxycinnamic acid that contributes to the overall antioxidant capacity), proanthocyanidins (PACs have strong antioxidant properties) and anthocyanins (antioxidant and anti-inflammatory properties). [1]

Cranberry fruit powder.

How does Cranberry fruit powder work in the skin?

<u>Cranberry promotes skin soothing activity.</u>

Cranberries contain anthocyanins that can exert anti-inflammatory effects by inhibiting the release of pro-inflammatory factors, reducing the expression of TLR4, and inhibiting the activation of the NF-$_K$B pathway and MAPKs signalling pathway. Meanwhile, they reduce the production of NO, ROS, and PGE_2 and avoid repeated stimulation. [2] Cranberries also contain quercetin which is not only a powerful antioxidant but has demonstrated anti-inflammatory activity as well, it also helps to reduce the production of pro-inflammatory cytokines. [3] Therefore, it can be deduced that cranberry will have a soothing effect on the skin.



Anthocyanins reduce external stimulation and inhibit the activation of NF-$_K$B signalling pathway. [2]

Cranberry fruit powder

Cranberry supports skin barrier function.

Vitamin C is found in all layers of the skin with a higher concentration in the epidermis where it stimulates the synthesis of ceramide-lipid compounds found in the stratum corneum that are responsible for maintaining proper skin hydration. [4] The omega-3 and -6 fatty acids reinforces the skin hydrolipidic film. (Information provided by raw material supplier).

Cranberry offers potent antioxidant activity.

The combination of polyphenols (flavonoids, phenolic acids, and tannins such as proanthocyanidins), tocotrienols (vitamin E) and vitamin C work in synergy offering powerful antioxidant activity that helps to protect skin cells against oxidative stress, fight free radical attacks and protect cell membranes from lipid peroxidation. [4]

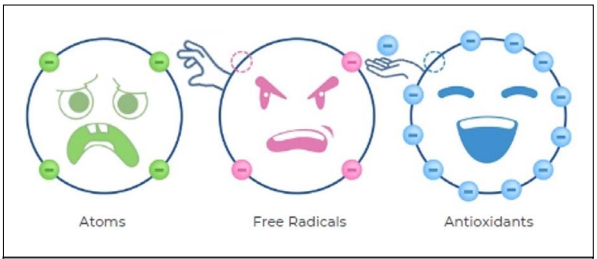


Illustration of antioxidant activity helping to neutralise free radicals. [5]

Cranberry offers age-reducing signs benefits.

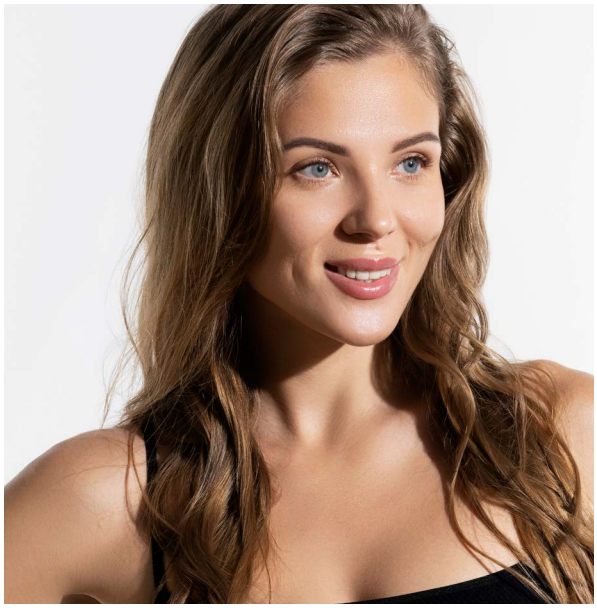
Vitamin C is a known antioxidant and also plays an important role in collagen synthesis, especially collagen I and III. Although the direct antioxidant protection provided by vitamin C is limited to aqueous compartments, vitamin C significantly prevents lipid peroxidation by regenerating lipid-soluble vitamin E. Vitamin C also inhibits melanogenesis and the enzyme tyrosinase. Topical application of vitamin C can significantly prevent oxidative damage caused by UVR. [4]

Vitamin E is present in areas of the skin that are particularly vulnerable to damage. Topical application of this group of antioxidants has been shown to reduce acute and chronic photodamage. Vitamin E reduces the harmful collagen-destroying enzyme collagenase, inhibits tyrosinase, and also reduces skin roughness and the depth of wrinkles. Moreover, it accelerates healing. [4]

Cranberry fruit powder skin benefits

Cranberry skin benefits

- Promotes a skin soothing activity.
  - Described anti-inflammatory effect.
  - Helps to reduce pro-inflammatory cytokines.
- Supports skin barrier function.
  - Promotes ceramide synthesis.
  - Enhances skin hydration.
  - Helps reduce TEWL.
- Potent antioxidant activity.
  - Fights free radical attack.
  - Helps to prevent oxidative stress.
  - Protects against lipid peroxidation.
- Age-reducing signs effect.
  - Promotes collagen synthesis.
  - Helps to reduce collagenase.
  - Promotes the reduction of skin roughness and wrinkle depth.
  - Helps to inhibit melanogenesis.
  - Contributes to reduce tyrosinase.



Strawberry seeds

What are Strawberry seeds?

Wild strawberry (*Fragaria vesca*) is a plant from the *Rosacea* family found in temperate and subtropical areas of the northern hemisphere. [6] The seeds are very small, around 1mm, and contribute to around 11% of the total polyphenol content of the whole fruit. The phytochemicals found in strawberry seeds include ellagic acid, ellagic acid glycosides, and ellagitannins. Strawberry seeds also contain antioxidants, including vitamin E and phenolic compounds. These antioxidants help protect the skin against oxidative stress and may have anti-inflammatory effects. Moreover, the seeds contain various minerals, including manganese, copper, and magnesium. [7]

Strawberry seeds. [7]

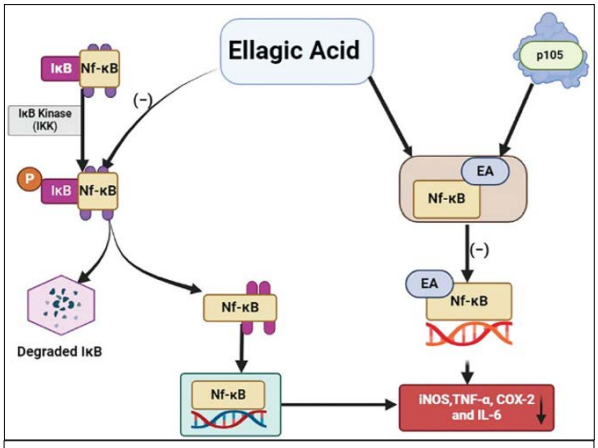
In this case the seeds of the strawberry is used, not the whole fruit and the concentration in skin care is much lower than oral consumption. Strawberry seeds are noted as safe in cosmetics with a very low risk of allergies or immunotoxicity. [8]

How does Strawberry seeds work in the skin?

Strawberry seeds have a skin soothing effect.

Research shows that tiliroside, is present as a major polyphenolic compound in strawberry seeds. Tiliroside has been documented to exhibit anti-inflammatory activities. In addition, the inhibitory effect of PPARα agonists and PPARγ ligands on cutaneous inflammation has been elucidated. [9]

Various pieces of evidence indicate that ellagic acid can inhibit the NF-$_K$B pathway, leading to the downregulation of the expression of inducible nitric oxide synthase (iNOS), tumour necrosis factor alpha (TNF-α), cyclooxygenase-2 (COX-2) and interleukin-6 (IL-6). [10]



Effects of ellagic acid on the NF-$_K$B pathway. [10]

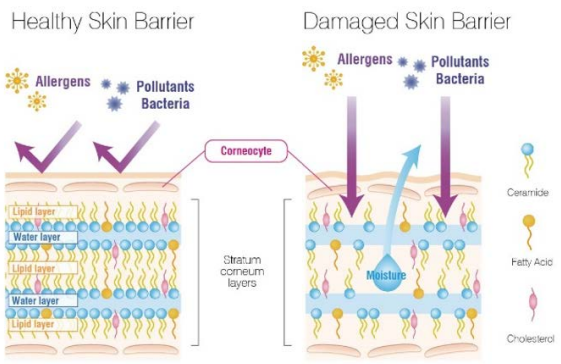
Strawberry seeds

Strawberry seeds supports skin barrier function.

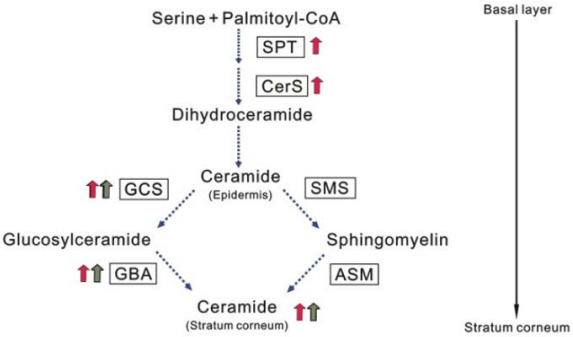
The lineage connection between ceramide synthesis and PPAR activity in the skin has been reported to indicate that PPARα, β / δ and γ are involved in skin barrier function by stimulating keratinocyte differentiation and proliferation and epidermal lipid synthesis. Furthermore, activation of PPARα has been demonstrated to increase ceramide content by accentuating the expression of SPT (serine palmitoyl transferase), GBA (β-glucocerebrosidase), SMS (sphingomyelin synthase), and ASM (acid sphingomyelinase). Although the activation of PPARβ / δ up-regulates the expression of GBA to increase ceramide content, the activation of PPARγ also stimulates the expression of GBA. [9]

The activation of peroxisome proliferator-activated receptor (PPAR) α can stimulate the expression of ceramide-related enzymes, and a major component of strawberry seed, tiliroside, enhances the expression of PPARα. [9]

The results of a study conducted on 3-dimensional human epidermal equivalents demonstrated that treatment with strawberry seed extract and its major component tiliroside, distinctly increased the ceramide content in the stratum corneum by enhancing the expressions of ceramide synthesis-related enzymes required for the glucosylceramide pathway, such as GCS (glucosylceramide synthase) and GBA (β-glucocerebrosidase). Furthermore, strawberry seed extract elicited greater increases in the stratum corneum ceramide content than tiliroside by additionally stimulating the expression of SPT2 (serine palmitoyl transferase-2) and CerS3 (ceramide synthase-3), common enzymes required for the formation of both glucosylceramide and sphingomyelin as an intermediate precursor of stratum corneum ceramide synthesis. Therefore, it is anticipated that strawberry seed extract may be effective in improving skin barrier function and moisture retention. [9]



An illustration showing the differences in skin barrier function between a healthy and damaged skin barrier. Note ceramides as an important component of healthy barrier function.



Stratum corneum ceramide synthesis-acceleration mechanism of strawberry seed extract and tiliroside. [9]

Increased expression by strawberry seed extract (red arrows) and tiliroside (green arrows).

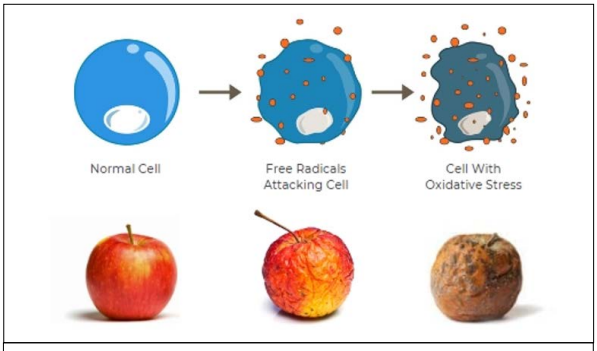
Strawberry seed extract increased the expression of SPT (serine palmitoyl transferase), CerS (ceramide synthase), GCS (glucosylceramide synthase), and GBA (β-glucocerebrosidase).

Tiliroside increased the expression of GCS and GBA.

Strawberry seeds

Strawberry seeds provide a powerful antioxidant action.

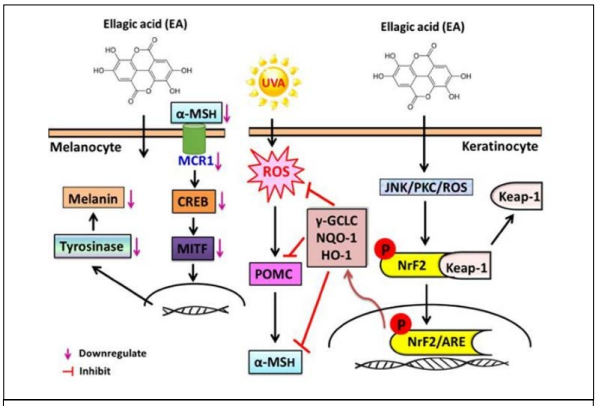
Both the ellagitannins and ellagic acid of strawberry seeds have antioxidant properties. [6] Ellagic acid has a free radical scavenging action that is linked to its inherent antioxidant characteristics. It has the capacity to scavenge a broad range of reactive nitrogen and oxygen species due to the presence of four hydroxyl and two lactone functional groups. The metabolites of ellagic acid are also capable of effectively scavenging a variety of free radicals, sometimes even quicker than ellagic acid itself; therefore, its antiradical activity is not diminished by its metabolism. [10]



The effect of free radicals on cells. [5]

Strawberry seeds contribute to a more even-toned skin.

The ellagitannins in strawberry seeds have antioxidant and anti-melanogenic activities, through a mechanism involving the decrease in the expression of tyrosinase, an essential enzyme catalysing the first steps of endogenous melanin production. Ellagic acid, produced from the hydrolysis of ellagitannins and also present in strawberry seeds, has also been reported to suppress melanogenesis. The depigmenting effect seems to be related to the tyrosinase antioxidant capacity. Another suggested possible mechanism is the inhibition of tyrosinase activity by ellagic acid, which regulates melanin production at the basal epidermal layer by quenching copper ions at the active site. [6]



The skin lightening effect of ellagic acid. [11]

Ellagic acid is a natural phenol antioxidant that inhibits melanogenesis in melanocytes through its action as a copper iron chelator at the tyrosinase enzyme's active site.

Skin protective effect.

Research indicated that the topical application of ellagic acid shielded hairless mice from skin wrinkle formation upon UVB-exposure. This favourable outcome was linked to a decreased production of proinflammatory cytokines (IL-1β and IL-6) and the alleviation of intercellular adhesion molecule-1 expression. [10]

Strawberry seeds skin benefits

Strawberry skin benefits

- Skin soothing effect.
  - Described anti-inflammatory properties.
- Supports skin barrier function.
  - Contributes to ceramide synthesis.
  - Helps to reduce trans epidermal water loss.
- Antioxidant action.
  - Free radical scavenging action.
- Skin brightening activity.
  - Reduces the expression of tyrosinase.
  - Promotes the quenching of copper ions, reducing tyrosinase activity.
- Skin protective properties.
  - Helps to inhibit pro-inflammatory cytokines.

Raspberry seeds

What are Raspberry seeds?

Raspberry seeds (*Rubus idaeus*) are a good source of healthy fats, mainly composed of omega-3 fatty acids. These essential fats support heart function, brain function, and help reduce inflammation in the body. The size of the seeds is around 2-3mm. An individual raspberry weighs 3-5g and is made up of around 100 drupelets, each of which consists of a juicy pulp and a single central seed. Raspberry seeds contain antioxidants including vitamin E and various phytochemicals such as anthocyanins, quercetin, and ellagic acid. Moreover, raspberry seeds contain essential minerals like magnesium, potassium, calcium, and phosphorus. Raspberry seeds also contain a small amount of vitamin C, an essential nutrient that plays a role in immune function, collagen synthesis, and acts as an antioxidant in the body. [12]

Raspberry seeds. [12]

How does Raspberry seeds work in the skin?

Compelling evidence showed that berry fruits possess antioxidative, anti-inflammatory, and anticarcinogenic properties because berries contain large amounts of phytochemicals, including flavonoids, tannins, stillbenoids, phenolic acid, lignans, triterpenes, and sterols. The traditional Chinese medicine book “Essential of Materia Medica” has described that raspberry could exhibit moisturising properties and reduce redness and swelling of the skin. Several bioactive constituents, including polyphenolic compounds, antioxidants, vitamins, and minerals have been extracted from red raspberries (*Rubus idaeus*). [13]

<u>Raspberry has a soothing action.</u>

Study results provided evidence that raspberry can inhibit UVB-induced inflammation and injury in the skin and is mediated by Nrf2 / HO-1 activation as well as suppression of the NF-$_{K}$B pathway, thereby promoting its clinical use in skin therapy. Furthermore, raspberry seeds seem to play a functional role against UVB-induced damage via suppressing the activation of p38 MAPK kinases induced by UVB irradiation. Previous research indicated that the blockade of the p38 MAPK pathway inhibited the expression of proinflammatory cytokines and COX-2. [13]

Raspberry seeds

In summary, the topical application of raspberry may protect against UVB-induced photodamage via activating the Nrf2 signalling cascade which is referred to as the master regulator of the antioxidant response, modulating various antioxidant enzymes. Raspberry may also inhibit MAPK p38 kinase, c-Jun, and NF-$_K$B to diminish UVB-induced skin inflammation. [13]

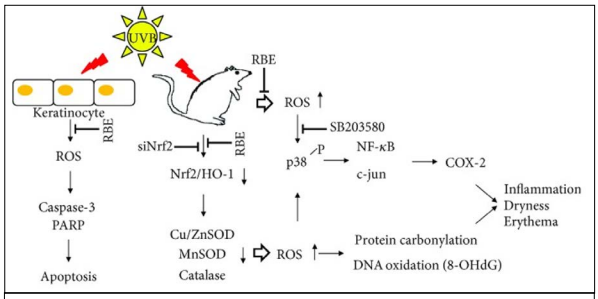
Raspberry supports skin hydration.

Raspberry has an important lipid component (such as omega 3 fatty acids) forming a hydrolipidic film on the epidermis which can protect the skin from trans epidermal water loss and induce the expression of genes involved in molecular pathways that support skin hydration and moisturisation, such as hyaluronic acid synthesis. [14] Vitamin C stimulates the synthesis of ceramide-lipid compounds found in the stratum corneum that are responsible for maintaining proper skin hydration. [12] Raspberry may also enhance skin barrier function and mitigate skin conditions such as photoageing. [15]

R. idaeus offers valuable ingredients to the cosmetic industry. Their incorporation, along with other red berries, into skincare formulations, among other benefits, contributes to improved skin regeneration. [15]

Raspberry offers powerful antioxidant activity.

The primary compounds in raspberry contain various types of antioxidants including cyanidin, ellagic acid, pelagonidin-3-sophoroside, and their derivatives. These bioactive compounds scavenge free radicals, particularly superoxide anions, and therefore may prevent skin injury since the increased oxygen-derived free radical has been suggested as a pivotal factor in UVB-induced skin problems. Research showed that raspberry can provide protection against UVB-induced death of skin cells by removal of oxidative stress. Research further revealed that the application of raspberry may significantly inhibit UVB-induced oxidative stress by upregulating catalase and superoxide dismutase (SOD) levels in photodamaged skin. [13]



Schematic diagram of UVB-mediated skin injury through the suppression of antioxidant enzymes and inducing oxidative modification of biological molecules such as protein and DNA. Raspberry application could protect the skin against UVB damage via enhancement of the antioxidant system as well as inhibition of inflammatory or apoptotic cascades. [13]

Raspberry seeds skin benefits

Raspberry skin benefits

- Skin soothing action.
  - Described anti-inflammatory properties helping to reduce skin redness and swelling.
  - Inhibits the expression of proinflammatory cytokines.
- Moisturising properties.
  - Helps to reduce trans epidermal water loss.
  - Supports skin barrier function.
  - Contributes to skin hydration.
- Antioxidant activity.
  - Reduces oxidative stress.
  - Protects skin proteins such as collagen and elastin as well as DNA of skin cells.

Algin

What is Algin?

Algin is extracted from brown seaweed through a process called “acid precipitation”. The seaweed is harvested, washed, and ground into a fine powder. Then an acid solution is added to the powder to separate the algin from the other compounds in the seaweed. Finally, the algin is isolated and dried into a powder for use in personal care products. [16] Combined with calcium salts, it forms a rigid gel used in ‘rubber or alginate’ masks. [17]

Algin powder.

How does Algin work in the skin?

Algin is commonly used in skin care and personal care products due to its hydrating and soothing properties. It has excellent water-binding capabilities, making it an effective moisturiser in skin care products. It helps in hydrating the skin and keeping it soft and supple. It is also used as a thickening agent in skin care formulations, improving the texture and viscosity of the products it is added to. [16]

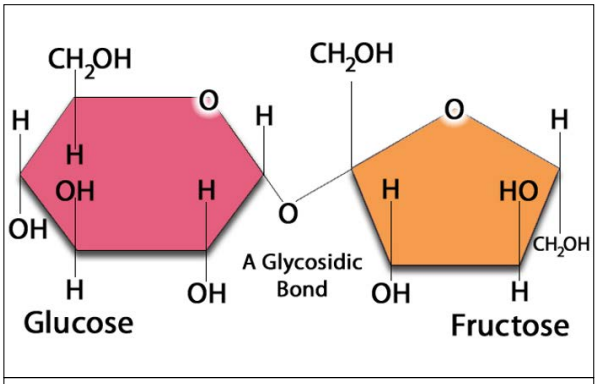
Algin skin benefits

- Soothing effect.
- Supports skin hydration.
  - Excellent water-binding properties.
  - Helps keep skin soft and supple.

Sucrose

What is Sucrose?

Sucrose is made through a process called photosynthesis in plants. During photosynthesis, plants use sunlight to convert carbon dioxide and water into glucose and fructose. These monosaccharides combine to form sucrose. Sucrose can be extracted from various plant sources, such as sugarcane and sugar beets, and further refined for use in various industries, including skin care. [18]



Sucrose. [20]

How does Sucrose work in the skin?

Sucrose is a naturally occurring disaccharide composed of glucose and fructose. In skincare applications, sucrose is use for its moisturising properties, thanks to numerous hydroxyl groups in the structure – it captures water molecules and enhances the skin's moisture retention. It contributes to the product's hydrating properties. [18,19]

Breaking down into glucose and fructose molecules, it energises skin cells stimulating their functions. [19]

Sucrose brings softness and comfort to the skin.

Sucrose skin benefits

- Promotes skin hydration.
  – Water-binding properties.
- Skin conditioning.
  – Brings softness and comfort to the skin.

Sensitive skin

Introduction

Along with the increasing subjective phenomenon of sensitive skin, surveys have become one of the popular approaches to evaluate the prevalence of this condition in the general population worldwide. Overall, it was found that 60-70% of women and 50-60% of men reported having sensitive skin. Epidemiological studies conducted in several countries in Europe, the United States, Russia, and Japan show that sensitive skin conditions occur in about 60% of women and 40% of men and affect the quality of life. Sensitive skin is also associated with geographical conditions, namely in areas with lighter-skinned people (Fitzpatrick skin types II-III) tend to experience sensitive skin more often than darker skin. [21]

An example of a sensitive skin.

According to the International Forum for the Study of Itch, sensitive skin is an uncomfortable sensation, such as stinging, burning, pain, itching, and tingling sensation that can sometimes be accompanied by erythema. This condition occurs not only on the face but can also affect the scalp and hands. Trigger factors can be physical, chemical, psychological, and hormonal factors. [21]

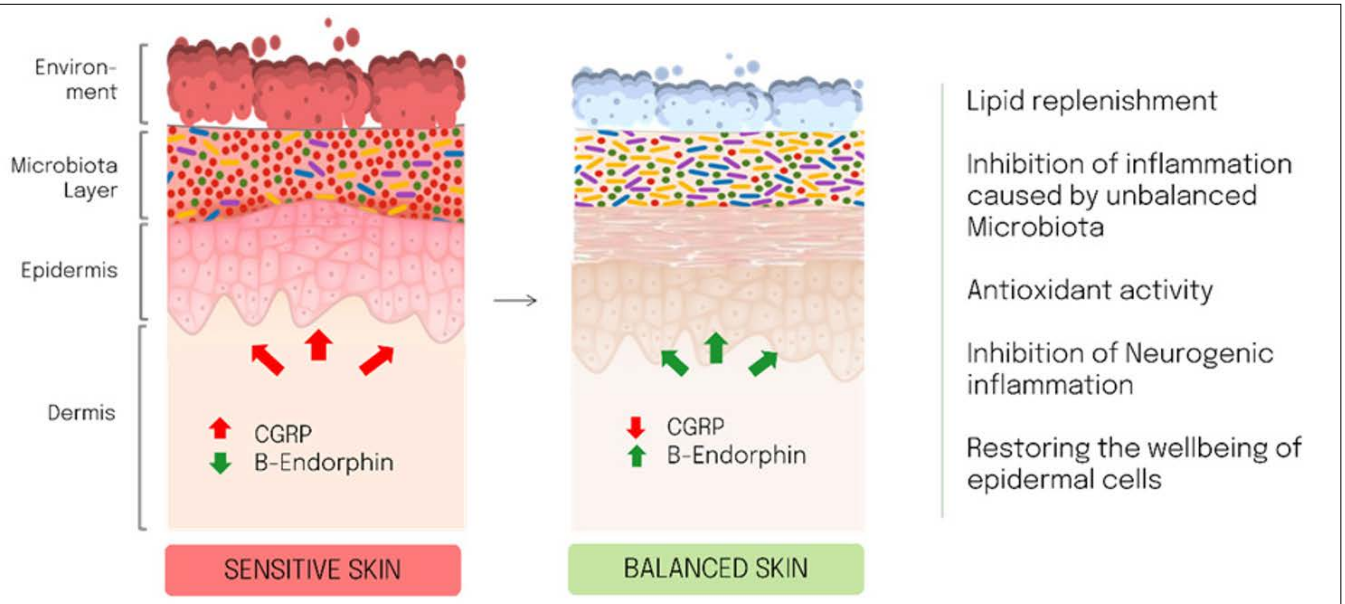
Pathophysiological characteristics of sensitive skin [21]

Skin barrier dysfunction	Neurosensory dysfunction
• Changes in trans epidermal water loss (TEWL).	• Increased innervation of the epidermis.
• Thinning of the stratum corneum.	• Decreased intra-epidermal nerve fibre density (C peptidergic nerve fibres).
• Decreased hydration of the stratum corneum.	• Increased neural sensory input.
• Decrease in the skin fat layer.	• Increased expression of transient receptor potential vanilloid-1 (TRPV1).
• Decrease in ceramide levels.	• Genetic variation in TRPV1 associated with susceptibility to capsaicin.
• Increased neutral lipids and decreased sphingolipids.	
• Increased activity of sweat glands.	

There are two characteristics associated with the incidence of sensitive skin, namely skin barrier dysfunction and skin neurosensory dysfunction as noted in the table above.

Sensitive skin

The decrease in skin barrier function causes the nerve fibre endings to become unprotected so that irritants or allergens can easily penetrate into the stratum corneum. Both of these will facilitate the recognition by antigen-presenting cells that can induce the inflammatory process. This mechanism also occurs in atopic skin conditions. A study showed that some subjects with sensitive skin showed signs of high vascular reactivity in the absence of skin barrier dysfunction. [21]



The skin barrier fulfils a multitude of functions. [22]

Several sensitive skin classifications [21]

Delicate	The skin barrier is easily disrupted without a rapid or intense inflammatory response.
Reactive	Strong inflammatory response without significant increase in skin permeability.
Irritable	Subjects with strong objective skin reactions after exposure to irritants or allergens.
Cosmetically sensitive	Transient reactive to certain cosmetic products.
Environmentally sensitive	Clean, dry, and thin skin with a tendency to blush or flush and reactive to environmental factors.
Very sensitive	Reactive to various endogenous and exogenous factors accompanied by acute and chronic clinical symptoms and strong psychological conditions. Subjects who declared themselves to have increased skin sensitivity.
Stingers	Enhanced neurosensory perception of minor skin stimulation. Individuals who consistently experience pain responses to chemicals.

Sensitive vs sensitised skin

There is a need to clearly distinguish skin irritation from skin sensitivity. Skin sensitivity is a fine-tuned response by the skin that is a known sensory organ. Sensitive skin, which should better be named reactive or hyperreactive or hypersensitive skin to avoid confusion, and irritated skin (orthoergic dermatoses) as well as sensitised (or allergic) skin are very different conditions in reaction to environmental factors. Table 1 summarises the differences. [23]

Table 1: Different types of skin reactions [23]

Type	**Irritated skin**	**Allergic skin**	**Sensitive skin**	**Atopic skin**
Pathophysiology	Chemical reaction	Allergy	Neuropathic disorder	Atopy*
Triggering factors	Irritant chemicals	Allergens	Physicochemical factors	Atopens**, stress
Affected individuals	All	Allergic	Reactive	Atopic
Area	Area of application	Area of application and beyond	Area of application and beyond	Widespread
Objective symptoms	Erythema	Erythema, vesicles (blisters)	Erythema	Erythema, vesicles (blisters)
Subjective symptoms	Pain	Pruritis (itching)	Paraesthesia (tingling)	Pruritis (itching)
Epicutaneous tests	Irritative type	Eczema	Negative	Eczema
***In vitro* tests**	Specific to irritants	Specific to allergens	Capsaicin, lactic acid	None

*Atopy: the genetic tendency to develop allergic diseases such as allergic rhinitis, asthma, and atopic dermatitis (eczema).

**Atopens: an agent inducing atopic allergy.

Sensitive vs sensitised skin

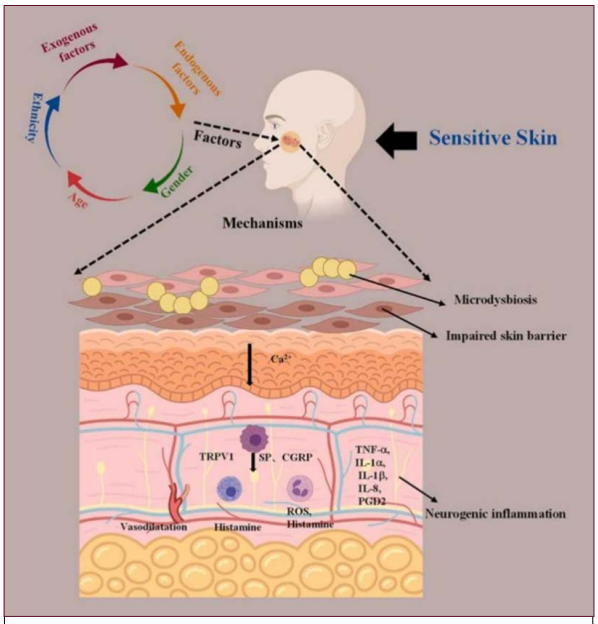
Sensitive and sensitised skin are terms often used interchangeably, but they refer to different conditions. Here's a breakdown of the differences:

Sensitive Skin
Definition: Sensitive skin is a skin type that is naturally more prone to reactions from external factors.
Characteristics:

- Inherent condition, often present from birth.
- Reacts to environmental factors such as wind, sun, and temperature changes.
- May have a genetic predisposition.
- Often associated with conditions like rosacea, eczema, or psoriasis.
- Symptoms include redness, dryness, itching, and a burning sensation.
- Reacts to certain skincare products or ingredients, causing discomfort. [24, 25, 26]

Sensitised Skin
Definition: Sensitised skin is a condition where the skin becomes reactive due to external factors or internal triggers.
Characteristics:

- Acquired condition, not inherent.
- Triggered by overuse of skincare products, harsh ingredients, environmental stressors, or lifestyle factors (e.g., stress, diet).
- Can affect any skin type at any age.
- Symptoms are similar to sensitive skin: redness, itching, burning, and dryness.
- Often caused by over-exfoliation, exposure to pollutants, or irritants in skincare products.
- Temporary condition that can improve with changes in skincare routine or environment. [25, 26]



The discomfort associated with sensitive skin can be triggered by various endogenous and exogenous factors. [24]

Key Differences

	Sensitive skin	Sensitised skin
Origin:	Genetic and typically present from birth.	Acquired due to external factors and lifestyle choices.
Duration:	Usually a lifelong condition.	Temporary and can be resolved by removing triggers.
Triggers:	Natural environmental factors, certain foods, and inherent skin conditions.	Overuse of skincare products, harsh ingredients, environmental pollutants, and stress.
Management:	Requires gentle, hypoallergenic skincare products, and avoiding known triggers.	Identifying and eliminating the specific triggers, adjusting skincare routines, and using calming, restorative products.

Understanding the difference between these two conditions is crucial for choosing the right skincare approach and avoiding exacerbating the symptoms.

Inflammatory response

Inflammatory response

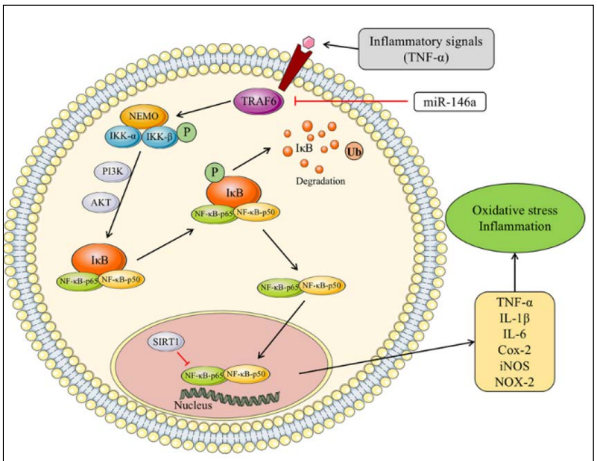
Inflammation is an essential innate immune process exploited by the host to initiate protective responses against various insults. Upon pathogen invasion and tissue damage, a rapidly mounted inflammatory response is critical for neutralising / eliminating pathogens and / or cellular corpses. However, once this goal is achieved, the inflammatory flame needs to be extinguished promptly to initiate tissue repair and regeneration, which ultimately restores homeostasis and organismal health. [27]

NF-$_K$B pathway

Nuclear factor-KB (NF-$_K$B) was first discovered as a transcription factor involved in B-cell development and activation. Subsequent studies established a broad role of this transcription factor in diverse cellular processes, including inflammation, cell proliferation and survival, differentiation of effector and regulatory T cells, and maturation of dendritic cells. [27]

Acting as a perfect example of a rapid response transcription factor, NF-$_K$B family members are retained in the cytoplasm in an inactive state in resting cells by binding to the inhibitor of NF-$_K$B (I$_K$B). Upon stimulation by PAMPs (pathogen-derived molecules), DAMPs (self-danger signals generated during tissue damage), or proinflammatory cytokines, the engagement of PRR (diverse pattern recognition receptors) and cytokine receptors triggers downstream signalling cascades, leading to the activation of the I$_K$Bs to liberate NF-$_K$B dimers for nuclear translocation, resulting in the expression of pro-survival and -proliferative genes, as well as various cytokines and chemokines to propagate inflammation.[27]

Once the inflammatory insults are cleared and inflammation is no longer needed, IKK is deactivated and I$_K$Bs accumulate and remove NF-$_K$B dimers from the DNA back to the cytoplasm. [27]



The mechanism of NF-$_K$B pathway in oxidative stress. [28]

As inflammation signals (such as TNF-α) phosphorylate I-KB proteins via the IKK / PI3K / AKT / NF-$_K$B pathway, I-KB proteins become ubiquitinated and degraded. When I-KB inhibition is lost, activated NF-$_K$B translocate to the nucleus, where it binds to target genes and releases inflammatory cytokines. Through targeted inhibition of tumour necrosis factor receptor-associated factor 6 (TRAF6), miRNA-146a can regulate the phosphorylation of I-KB, thereby reducing the expression level of NF-KB and inflammation. Silent information regulator 1 (SIRT1) can inhibit transferring of NF-$_K$B to the nucleus and prevent the binding of NF-$_K$B to inflammation-related gene promotors.
(P: phosphorylation; UP: ubiquitination).

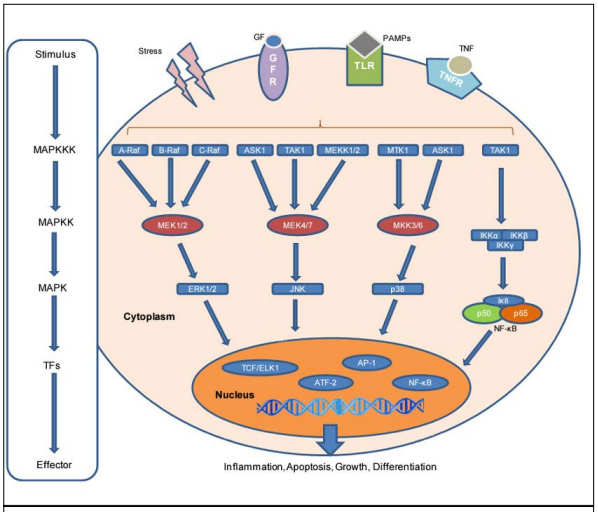
Inflammatory response

MAPK pathway

The mitogen-activated protein kinase (MAPK) belongs to the serine / threonine kinase family and plays an important role in diverse cellular programs such as proliferation, differentiation, development, transformation, inflammatory responses, and apoptosis by transmitting, amplifying, and integrating signals from a broad spectrum of stimuli. MAPK signalling is a conserved enzymatic cascade that mediate signal transduction from the cell surface to the nucleus through phosphorylation events. This pathway involves three key enzymes. [29]

MAPK is responsible for phosphorylating target proteins in the cytoplasm or nucleus. MAPKs in mammalian cells mainly include extracellular regulated protein kinase (ERK), p38 MAPK, c-Jun N-terminal kinase (JNK), and extracellular regulated protein kinase 5 (ERK). The transcriptional specificity of NF-$_K$B can be achieved through interaction with the MAPK pathway. Evidence of NF-$_K$B signalling's interaction with MAPK signalling has primarily centred on JNK signalling.[29]

The JNK pathway regulates cell cycle progression through multiple mechanisms. Studies investigating the interaction of NF-$_K$B signalling with JNK signalling have revealed that although JNK signalling regulates cell death or survival, the ultimate fate of the cell is determined by NF-$_K$B, and activation of NF-$_K$B signalling is capable of inhibiting pro-apoptosis induced by caspases, JNK, and reactive oxygen species (ROS).[29]



MAPK signalling pathway. [30]

The MAPK signalling pathway is stimulated by stress, growth factors, pathogen-associated molecular patterns and inflammatory cytokines.

Various transcription factors lead to the expression of genes encoding inflammatory cytokines, cell differentiation, growth and apoptosis.

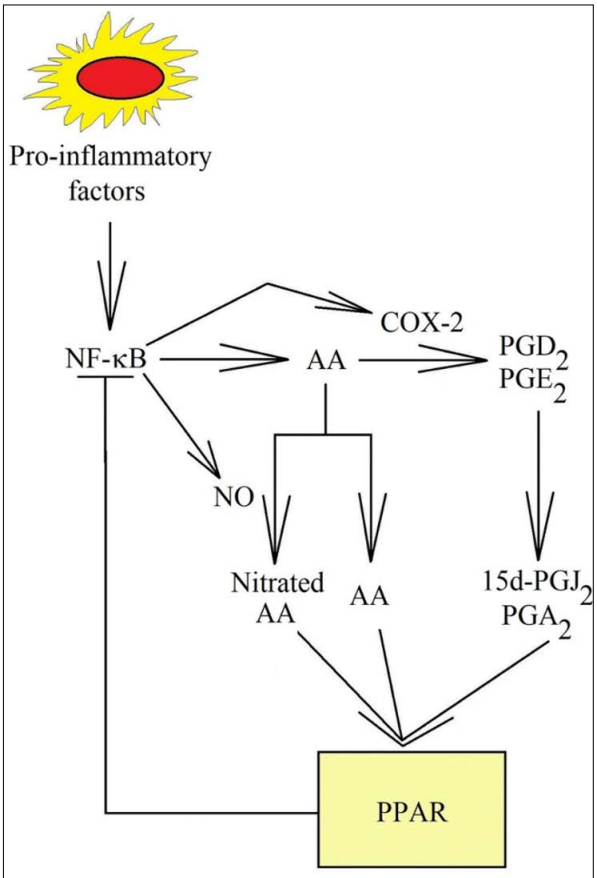
Inflammatory response

PPARα agonists and PPARγ ligands

The peroxisome proliferator-activated receptor (PPAR) family includes three transcription factors: PPARα, PPARβ/δ, and PPARγ. PPAR are nuclear receptors activated by oxidised and nitrated fatty acid derivatives as well as by cyclopentenone prostaglandins (PGA_2 and 15d-PGJ_2) during the inflammatory response. This results in the modulation of the pro-inflammatory response, preventing it from being excessively activated. Other activators of these receptors are fatty acids, especially polyunsaturated fatty acid (PUFA). [31]

The main function of PPAR during the inflammatory reaction is to promote the inactivation of NF-$_K$B. They promote the expression of antioxidant enzymes, such as catalase, superoxide dismutase, or heme oxygenase-1, resulting in a reduction in the concentration of reactive oxygen species (ROS), i.e., secondary transmitters in inflammatory reactions. PPAR also cause an increase in the expression of IKBα, SIRT1, and PTEN, which interferes with the activation and function of NF-$_K$B in inflammatory reactions. [31]

After certain treatments, the skin may present with a situation of tightness, redness and slight inflammation that can lead to skin discomfort. The management of these signs is key to offering the skin seeking comfort and preparation to carry on with the rest of the steps in a skin care regime.



Self-regulation of NF-$_K$B activity and COX-2 expression. [31]

In inflammatory reactions, NF-$_K$B is activated and, partly as a result of this, an increase in expression and activity of enzymes of the prostaglandin synthesis pathway takes place. Released AA (arachidonic acid) is converted into PGD_2 or PGE_2. In inflammatory reactions, the production and concentration of NO also increase. With time, all of the compounds react together or undergo further non-enzymatic transformation. AA in reaction with NO is subject to nitration. PGD_2 and PGE_2 convert to 15d-PGJ_2 and PGA_2, respectively. Compounds with anti-inflammatory properties are formed, which activate PPARα and PPARγ. Activated PPARα and PPARγ inhibit the activity of NF-$_K$B, which leads to inhibition of inflammatory reactions by the products of these reactions.

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