



Hair Removal Creams: Mechanism of Action, Efficacy, and Safety Considerations

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ABSTRACT

Hair removal creams, also known as depilatory creams, have become a popular, non-invasive method for temporary hair removal. This review delves into the mechanism of action of these creams, primarily focusing on how active ingredients such as calcium thioglycolate and potassium hydroxide break down keratin in the hair. The anatomy of hair is discussed to understand the target structure these creams affect. The review further compares different hair removal cream formulations, evaluates their efficacy, duration of hair removal, and safety profile, and highlights the chemical reactions involved. A comparative analysis with other hair removal techniques, such as waxing and shaving, is presented to gauge the relative effectiveness of creams. Moreover, the safety aspect is critically examined by identifying common and rare adverse effects, contraindications, and user perspectives. This review aims to provide a balanced understanding of the efficacy, safety, and user preferences associated with hair removal creams, contributing to informed consumer choices and safer use practices.

KEYWORDS - Hair removal cream, Depilatory cream, Mechanism of action, Efficacy, Safety, Active ingredients

INTRODUCTION:

There are between 100,000 and 150,000 human hairs, and each one grows and sheds during different stages of the hair cycle. Proteins make up around 88% of hair. These proteins belong to the rigid, fibrous keratin class. Long strands of amino acids make up proteins. Keratin proteins comprise the cytoskeleton of all epidermal cells. The amino acid cysteine makes up the majority of the keratin proteins present in hair fiber. The sulfur atoms in cysteine are held together by bonds known as disulfides. These disulfide bonds are incredibly strong and difficult to break. [1] Chemical hair removal creams, often known as depilatories, are cosmetic preparations used to remove hair from the skin. They work by dissolving sulfur linkages in hair keratin that are susceptible to strong alkaline and deoxidation agents. A salt of thioglycolic acid is the material that actively breaks down the sulfur bonds. To keep thioglycolic acid as an active dianion in the product, a high concentration of hydroxide ions is achieved using strong alkalis, such as sodium hydroxide. Hair removal creams have been investigated for use as penetration enhancers for transepidermal medicine administration because of the active ingredient thioglycolate. [2] Oil-water emulsions that are semi-solid make up creams. Creams that are oil-in-water (O/W) include tiny oil droplets that are dispersed throughout the water phase. Because oil-in-water lotions are less oily and easier to remove with water, they are more comfortable to use and more aesthetically acceptable. [2] Creams for removing hair from the skin's surface that are chemical-based are called depilatory creams or hair removal creams. The active components in these lotions, including potassium hydroxide or calcium thioglycolate, weaken the keratin structure of hair so that it can be readily removed. Unlike shaving, which cuts hair at the surface, depilatory creams dissolve hair just below the skin, offering smoother results for a slightly longer duration. They are widely used for their convenience and pain-free application, though some users may experience skin irritation or allergic reactions. [2]

ANATOMY OF HAIR:

Every hair strand consists of two unique components. The hair shaft is the visible section of the skin that lies outside of the hair follicle, which is located beneath the skin's surface. The hair follicle also has two root sheaths: an inner and an outer one. Hair is composed of both living and non-living materials, both above and below the epidermis. The hair shaft is a thin, flexible cylinder

composed of dead keratinized epithelial cells that rests above the epidermis. Beneath the epidermis lies a section of a living hair follicle that grows at the base to form the hair bulb. [2] The infundibulum, isthmus, and inferior segment are the three main hair follicle segments on the head. The top part of the follicle, known as the infundibulum, extends from the epidermal surface to the sebaceous duct entrance. The space between the bulge and the opening of the sebaceous duct is known as the isthmus. Many epidermal stem cells that are a component of the outer root sheath can be found in the bulge, which is identified by the location of the arrector pili muscle insertion. The inferior segment reaches the follicle's base from the bulge. The bulb, which has the follicular matrix around the top and sides of the dermal papilla, is a part of this segment. [3] There are hair roots and hair shafts in every hair. The visible portion of the hair that protrudes from the skin is called the shaft. The hair root is located in the skin and reaches the skin's deeper layers. The hair follicle, which is attached to a sebaceous gland, encircles it. Every hair follicle has a little muscle linked to it that has the ability to raise the hair. And at the hair follicle, several nerves terminate. These nerves are sensitive to even the smallest draft and detect movement in the hair. The hair root broadens to form a rounded hair bulb at the base of the hair. Inside the base of the hair bulb is the hair papilla, which provides blood to the hair root. [4]

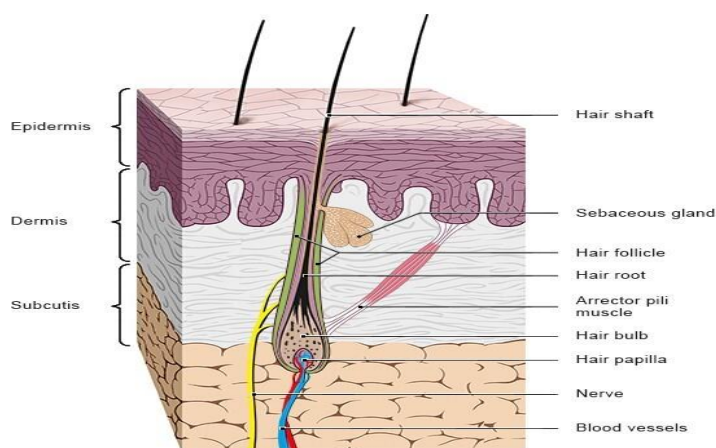


Fig No.1 Anatomy of Hair

MECHANISM OF ACTION:

The primary structural component of hair strands is keratin, a fibrous protein with a significant concentration of the amino acid cysteine. Hair is made strong by keratin, a structural protein reinforced by disulfide connections. Since sulfur is a component of cysteine, many cysteine residues are necessary for disulfide bonds to form, which give hair its stiffness and heat durability. Hair removal creams function by starting chemical reactions that cause the keratin structure of hair to break down. Hair removal lotions work by breaking down disulfide bonds, and one common ingredient in this procedure is calcium thioglycolate. When the thioglycolate salt breaks, the hair's structure is upset, making it weaker and more easily removed from the skin by wiping and washing the cream off with water. [2]

ACTIVE INGREDIENT USED:

STANNITES:

The usage of "soluble stannite's received a lot of interest in the 1930s. Sodium stannite solution is described as a depilatory in several patents. Their instability (they generate stannates when exposed to water) has led to their widespread abandonment despite their tolerably mild odor. However, it was discovered that the suggested stabilizers were ineffective and did not result in stable preparations.

SUBSTITUTED MERCAPTAN:

Most depilatories on the market today are based on substituted mercaptans, which are combined with calcium hydroxide in the presence of alkaline-reacting substances (such as calcium thioglycolate). They can be used on the face, where excessive hair can cause severe distress and women have a strong psychological reluctance to shaving, because they are kinder to skin than sulfides.

THIOGLYCOLATES:

Preparations based on thioglycolates are stable and nontoxic at use concentrations, which range from 2.5% to 4%. Depending on the preparation's pH, they may cause depilation in 5 to 15 minutes at common use doses of roughly 4%. This needs to be at least pH 10, but ideally it should be closer to pH 12.5 to cause depilation quickly without causing skin irritation.

OTHER "THIO" COMPOUNDS:

The most affordable and efficient active ingredient of this kind is thioglycolic acid. However, due to legal restrictions on their use at home, thioglycolates have been replaced with thiolactic acid, 3-mercaptopropionic acid, or thioglycerol in certain goods. [6]

CHEMICAL REACTION INVOLVED:

Hair removal creams function by dissolving disulfide bonds, frequently with the aid of calcium thioglycolate. The structure of the hair is disrupted by the thioglycolate salt, which disrupts the disulfide bonds in keratin. The hair can be easily removed from the skin by wiping and washing off the cream with water after these ties are broken. [7], [8]. The chemical reaction is:

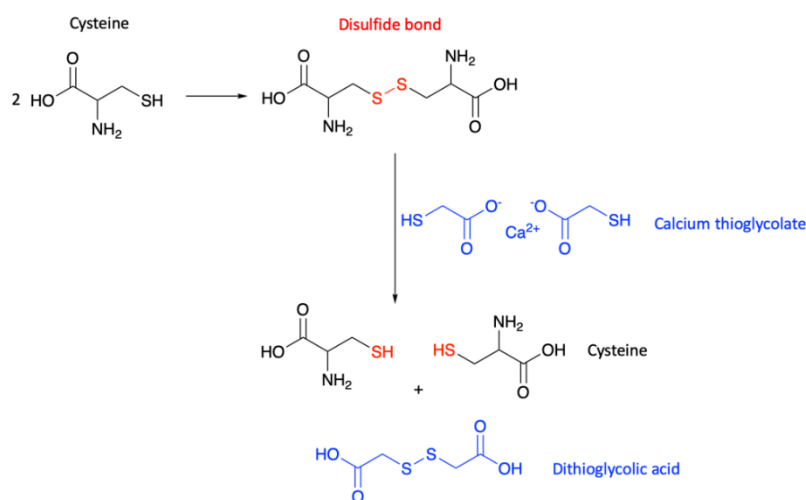


Fig No.2 Chemical Reaction Involved

HOW CREAM INTERACT WITH IT:

Depilatories, another name for hair removal lotions, are used to safely remove unwanted hair from the body. They act like a lotion or spray, dissolving the protein connections that keep hair under the skin's surface intact. This makes it simple and painless to remove the weaker hair. [9] The keratin structure, or the proteins, of the hair, is broken down by depilatory creams. In doing so, the hairs' base is effectively thinned and dissolved, becoming weak enough to break off when the cream is removed. Many alkaline compounds that are both harmless for your skin and designed to break down these proteins are commonly found in the lotions. Naturally, different skin types have varying degrees of sensitivity, so it's critical to select the appropriate cream for you and to test its application on a tiny area of skin before attempting to remove hair from a larger area. [10]

COMPARISON OF DIFFERENT CREAM FORMULATION:

Best Hair-Removal Cream Overall

Flamingo Body-Hair Removal Cream



Fig No .03 Flamingo Body-Hair Removal Cream

I swear to you all that this hair-removal cream is the only reason I've completely stopped getting waxed, shaving, or having my bikini line trimmed. Every hair is broken down by the solution, leaving the hair incredibly smooth for approximately a full week until it becomes necessary to trim the borders or spot-treat a few individual hairs. And because of a combination of calming urea and bisabolol, it accomplishes so without in the slightest upsetting skin. After eight to ten minutes, when I remove the cream with a washcloth, my skin feels nourished even without any makeup on it. To be honest, I've also been using the equally hydrating Flamingo Facial-Hair-Removal Cream to get rid of peach fuzz.

Key ingredients: Thioglycolic acid (chemical hair remover), urea, bisabolol, shea butter.

Best One-and-Done Hair-Removal Cream

Neomen Hair-Removal Cream



Fig No.04 Neomen Hair-Removal Cream

After testing dozens of hair removal products, I've come to the conclusion that my favorites need little to no skill. In other words, I don't have time to apply a product, wait ten minutes, and still have hair on my leg. However, I really only need to apply one application of this light cream to have perfectly smooth legs. Surprisingly, I thought the formula was really mild.

Key ingredients: Thioglycolic acid (chemical hair remover), aloe Vera, allantoin

Best Hair Removal Cream for Sensitive Bikini Lines

Nad's Sensitive Hair Removal Cream



Fig No.05 Nad's Sensitive Hair Removal Cream

Because your bikini area is prone to irritation, a depilatory cream that you apply on delicate skin ought to be enriched with moisturizing and calming components, like the one in this Nad product. It's formulated with calming aloe vera, honey, and moisturizing avocado and shea butter to help keep the delicate skin on your bikini line from freaking out or getting irritated.

Key ingredients: Potassium thioglycolate (chemical hair remover), shea butter, aloe vera, avocado oil, honey.

Best Hair-Removal Cream for Dry Skin

Nad's 3-in-1 Hair Removal Body Butter



Fig No.06 Nad's 3-in-1 Hair Removal Body Butter

It's quite acceptable for the majority of hair-removal treatments to be lightweight and liquid, unless you already have dry, scaly skin that could use a little more care. Enter now: This rich recipe from Nad's helps to gently moisturize and caress your skin while the product works its magic on your hair. It contains urea, glycerin, sweet almond oil, and shea butter. After four to six minutes, leave it on and use a washcloth or the shower to remove it.

Key ingredients: Potassium thioglycolate (chemical hair remover), urea, glycerin, sweet almond oil, shea butter. [11]

EFFICACY:

For at-home hair removal, shaving and depilatory lotions are both painless alternatives. In both cases, hair is removed from the skin's surface. Depilatory creams cause less irritation to the skin and leave fewer skin lesions or papules than shaving does. Generally speaking, the minor cuts and nicks you could receive with a blade fade more quickly than the irritation caused by hair removal treatment. [13] One advantage of utilizing the cream is that it won't cause you any discomfort, unlike shaving or waxing. [16]

Our requirements and preferences differ when it comes to shaving off undesirable hair. What is most effective for you is what counts most. Nevertheless, if you were to question a fan of depilatory creams why they use them, they would most likely respond as follows:



Painless and user friendly (most of time):

Plucking, waxing, threading, and sugaring are all rather painful. In principle, shaving shouldn't hurt, yet it's uncommon to emerge from a shaving session entirely unscathed. However, depilatory creams can be absolutely painless depending on your skin type! Another benefit of depilatory creams is their ease of usage. Just remember to perform a patch test beforehand. From there, you should be fine as long as you strictly adhere to the instructions on the box, bottle, or tube!

Skin and hair effects:

In contrast to most hair removal methods, depilatory creams actually enter the skin, according to Scarso. They consequently frequently contain a lot of moisturizers. Additionally, it frequently happens that the hair grows back a little bit finer than it did originally.

An affordable option:

Depilatory creams are less expensive than some other available methods for hair removal. Although purchasing these products can get expensive, any method that eliminates hair beneath the skin will be more durable than shaving. Furthermore, using depilatory lotions is unquestionably less expensive than visiting a salon or spa.

An accessible option:

In case you are afraid of using a razor or have issues with your physical dexterity, depilatory creams are an excellent at-home substitute for shaving. [15]

DURATION OF HAIR REMOVAL:

Give it a time. The majority of hair removal creams have a recommended application time of three to ten minutes. To find out precisely how long you need to leave your cream on, read the instructions on the container. Wash it out. After the allotted amount of time, remove the cream with a cloth and wash your skin with cold water. The skin may first feel sensitive, which is typical. In a few hours, this feeling ought to pass. [13] Hair removal creams, also called depilatories, function by gradually dissolving hair into a jelly-like substance that can be wiped off. They achieve this by using a strong alkaline solution. The hair should easily come off with the mixture when it is removed. You can still notice a shadow beneath the skin if you have thick, black hair because this procedure doesn't remove hair from the follicle itself. [14]

COMPARISON WITH OTHER HAIR REMOVAL METHODS:

Between November 2013 and October 2015, a prospective and comparative study was carried out in the General Surgery Department at Command Hospital (WC), Chandimandir, Panchkula. There were 100 patients in all, 50 in each group, for this study. 46 individuals underwent total hair removal with depilatory cream, compared to 31 who underwent complete hair removal using a shaving blade. Application of depilatory cream was substantially more related with complete hair removal than shaving with a razor. There were no patients who had skin injuries from depilatory lotion, while 14 patients suffered single, numerous, or major cuts from shaving razors. It also demonstrated that using depilatory lotion was safer than using a razor to shave. Skin reactions were brought on by depilatory lotion in three cases and shaving razors in one patient. The group using shaving razors required less time to remove hair than the group using depilatory cream; the mean time required for hair removal in the shaving razor group was 15.72min, while the mean time required in the depilatory cream group was 25.48min. [17] When hair removal creams and waxing are compared, hair removal lotions remove hair painlessly, whereas waxing might be uncomfortable. However, waxing is the best option for results that last. [18] The primary drawback of depilatory creams is their chemical composition, among other drawbacks. Depilatory creams contain chemicals that destroy hair, but they can also cause negative skin reactions. Additionally, hair regrows considerably faster with depilatory creams than with other hair removal techniques since they do not eliminate undesirable hair by the root. [19]

FACTORS INFLUENCING EFFICACY:

SKIN FACTORS:

1. **SKIN TYPE:** The effectiveness and absorption of creams might be impacted by normal, dry, oily, or sensitive skin.
2. **SKIN pH:** Hair removal lotions function best at a pH of 5.5 to 6.5. Deviations may lessen effectiveness.
3. **SKIN TEMPERATURE:** For efficient hair removal, a temperature range of 20 to 30 degrees Celsius is ideal.



4. **SKIN disorders:** Skin disorders such as psoriasis, acne, or eczema might influence how well a cream absorbs and raise the possibility of irritation.

HAIR FACTORS:

1. **HAIR TYPE:** Cream removal and penetration are impacted by thin, thick, coarse, or fine hair.
2. **HAIR COLOR:** Hair removal treatments work better on dark hair than on light or blonde hair.
3. **HAIR LENGTH:** 1 to 5 mm is the ideal length to cut.
4. **HAIR GROWTH RATE:** More frequent treatment may be necessary for faster growth rates.

PRODUCT FACTORS:

1. **ACTIVE substances:** The effectiveness of thioglycolate, calcium thioglycolate, and other substances varies.
2. **CONCENTRATION:** Potent concentrations have the potential to be more effective but also irritate.
3. **pH LEVEL:** For best effectiveness, the pH of the product and skin should match.
4. **VISCOCITY AND TEXTURE:** The texture of a cream influences how it is applied and absorbed.

APPLICATION FACTORS:

1. **APPLICATION TIME:** Inadequate time may cause effectiveness to decline.
2. **AMOUNT APPLIED:** Insufficient dosage may cause ineffectiveness.
3. **EVENNESS OF APPLICATION:** Patchy effects may arise from uneven application.

ENVIRONMENTAL FACTORS:

1. **TEMPERATURE:** The effectiveness of creams can be impacted by extremely high or low temperatures.
2. **Humidity:** High humidity may lessen the effectiveness of creams.
3. **LIGHTING:** Application and removal might be impacted by lighting conditions.

SAFETY:

Avoid these products if you have sensitive skin or are allergic to fragrances. Additionally, be sure to apply the lotions just to the areas of the body for which they are meant. Even while many of the more recent formulas smell better than they did years ago, some people may find the scent bothersome. Think about this before heading outside because the skin will become more susceptible to the sun's rays later. You risk getting a chemical burn if the lotions are not used according to instructions. Lastly, there's a chance for uneven outcomes, which could be problematic for larger regions like the legs. You don't want to overuse the product in the same region, therefore it's advisable to wait a few days and reapply if this occurs. [23]

Before using HAIR REMOVAL CREAM for the first time:

Before using this product, see your doctor if you have any medical conditions that could impact your skin, or if you are on any medications. Conduct a test on a tiny portion of the region that needs to be depilated before to the first use. Continue using the product if no negative reaction occurs within 24 hours of application. When using it, if you experience any itching, burning, or tingling, take it off right away and rinse with lots of cold water. If the symptoms don't go away, consult a doctor. Always give applications a 72-hour break in between.

After hair removal:

After hair removal, avoid exposing the skin to direct sunlight for 24 hours. After hair removal, avoid using deodorants or products with alcohol in the depilated regions for 24 hours. [24]

COMMON ADVERSE EFFECTS:

You should be aware of the following drawbacks of hair removal creams because they include chemicals. Here are five adverse effects of hair removal lotion that you should be aware of:



Skin darkness and irritation:

The majority of hair removal creams contain thioglycolic acid salts and compounds like potassium and calcium hydroxide, which can irritate delicate skin types and result in black spots. This implies that in order to avoid irritation and darkening, it's crucial to avoid using hair removal treatments prior to completing a patch test and to stay away from sensitive parts of your skin.

Skin damage and allergic reactions:

These hair removal treatments' acidic ingredients have the potential to combine with your skin and change its pH, resulting in adverse reactions like rashes and skin damage. Because of this, before using hair removal cream on the face or intimate areas, it is imperative to be aware of its potential negative effects.

Chemical burns:

Hair removal creams can potentially result in severe first- and second-degree chemical burns if misused or left on the skin for extended periods of time! Therefore, it is essential to read the directions before using such medicines and to always follow the recommended period. Furthermore, be in mind that applying these treatments to recently waxed or shaved skin may also have unfavorable results.

Unpleasant smell:

The majority of hair removal creams have a strong, disagreeable smell that is similar to rotten eggs. Hair removal creams are not for those who are sensitive to strong perfumes or who would prefer a more pleasant hair removal experience because this smell seems to get worse when the cream comes into touch with body hair.

Not ideal for sensitive areas:

While it is true that hair removal creams can be used to get rid of unwanted hair from your bikini area, most dermatologists do not advise doing so. This is because there is a great likelihood that applying hair removal cream on the pubic area will cause you to experience some negative effects because your skin there is extremely thin and sensitive.

In summary, hair removal creams are convenient, painless, and straightforward to apply. Nevertheless, the chemicals they contain have the potential to have a number of detrimental side effects, including skin damage, irritation, darkening, allergic reactions, and, worst of all, chemical burns. [25]

RARE BUT SERIOUS SIDE EFFECTS:

Skin rashes and sensitive skin:

The way hair removal creams operate is one of its main drawbacks. Chemicals harm and break hair when they remain on it. The chemicals in hair removal creams, such as potassium and calcium hydroxide, can cause skin irritation or discoloration. Sensitive skin types may endure uncomfortable feelings for extended periods of time before breaking out in a rash.

Allergic reactions and skin damage:

Since the pH of your skin is slightly acidic, the pH of these lotions may have an adverse effect on it and cause damage. Those with sensitive skin may detect the damage more readily. Therefore, you ought to conduct a patch test prior to using it on a significant area of the skin. This study discovered that hair removal lotions can harm skin even if they are only a residue. It was published in the Journal of the American Association for Laboratory Animal Science.

Chemical burns:

If you use the cream for an extended period of time, it can cause first- or second-degree chemical burns to your skin in addition to breaking down your hair. And the answer to the question, "Does hair removal darken skin?" is yes! Skin can become dark due to chemicals such thioglycolic acid, potassium hydroxide, and calcium hydroxide.



Can increase hair growth:

It's possible that you will be shaving your hair today, but the result can be fuller hair. According to this research, which was published in The Korean Journal of Physiology and Pharmacology, using hair removal treatments may potentially lead to an increase of hair follicles. [26]

CONTRAINDICATIONS:

Not everyone will benefit from using thioglycolic acid topically, as you might obviously anticipate. It is always important to use caution when applying cosmetics on skin that is impaired in any way. This encompasses those with delicate skin or ailments such as rosacea, eczema, psoriasis, and even sunburn or acne. It also covers those who use skin care products that exacerbate skin sensitivity, such as retinoids or retinols. [5]

PRECAUTIONS FOR USE:

Do a patch test: Before using a depilatory cream, it's crucial to ensure that your skin won't react adversely to it by conducting a patch test. Before using any kind of cream on a big portion of your body, always test it on a small section of your skin. Generally speaking, remove the cream as soon as possible with cool water if you experience burning while it's on.

Make sure it's a right one: Choose a cream that says it's safe to apply to the area where you don't want hair to grow. Certain formulae are more potent than others and can be too powerful for delicate skin. Applying it to injured or irritated skin is not advised.

Time it: The majority of hair removal creams have a recommended application time of three to ten minutes. To find out precisely how long you need to leave your cream on, read the instructions on the container.

Rinse it off: After the allotted amount of time, remove the cream with a cloth and wash your skin with cold water. The skin may first feel sensitive, which is typical. In a few hours, this feeling ought to pass.

After care: To ease any inflammation, apply a calming cream afterwards. Apply a fragrance-free moisturizing moisturizer to the dry areas of your skin. Most importantly, avoid using scented items. [13]

USER PERSPECTIVE AND PREFERENCES:

Smooth skin free from the agonizing processes of shaving or waxing nicks and sores. These are breakthrough creams for folks in need of an easy, quick remedy. Additionally, they are available in different formulations to suit sensitive skin as well as other skin types. They are fantastic for the bikini line, arms, legs, and underarms. Many believe that the ease and comfort make it worthwhile. Consequently, using hair removal cream could be the best way to simplify your grooming routine. [27]

Smooth skin can be achieved with depilatories without the usual rashes that come with shaving. Hair removal lotions help prevent ingrown hairs, wounds, nicks, and razor stubble. Therefore, hair removal creams win out in terms of convenience, longer-lasting results, and avoiding typical skin irritations. Furthermore, the longer-lasting smooth, hair-free skin that a hair removal cream provides might just last until you're rescued in the unusual event that you find yourself stuck on a desolate island—although hair removal probably wouldn't be your top priority. [18] The most convenient option ultimately comes down to individual priorities and tastes. Hair removal creams disintegrate hair with little effort, making them the ideal choice if you're searching for a painless, hassle-free solution. However, you should speak with your dermatologist before using any product if you have any skin issues, sensitivities, or concerns about odor. In contrast, the greatest tools for precise and speedy hair removal are razors. They work well for on-the-spot touch-ups and are shower-safe. But, in order to prevent cuts or discomfort, shaving necessitates more frequent change of the blade and greater attention. The greatest hair removal creams are those that are simple to use and remove hair without causing pain. [28]

CONCLUSION:

Hair removal creams offer a convenient, painless method of removing unwanted hair, particularly for those who prefer not to undergo more invasive procedures. Their mechanism relies on breaking down the hair structure at the skin surface, with active ingredients such as thioglycolates playing a crucial role. While these creams are generally effective, offering smooth skin for a limited duration, individual results may vary depending on the formulation, hair type, and skin sensitivity. Safety remains a concern, with common adverse effects like irritation and rare but serious reactions such as chemical burns. Proper precautions and adherence to usage guidelines are critical to minimizing these risks. When compared with other methods like shaving or waxing, depilatory



creams present a middle ground in terms of efficacy and convenience. Overall, hair removal creams are an effective option when used correctly, though user preference for other methods might depend on personal comfort, skin type, and desired results. Further research into reducing side effects while improving efficacy could enhance the value of these products.

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