

FORMULATION AND EVALUATION OF BURDOCK ROOT BASED CREAM FOR THE TREATMENT OF ECZEMA

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ABSTRACT:

Burdock, also known as *Arctium lappa*, is promoted as a nutritious and healthy food in China. Burdock has been used therapeutically in Europe, North America, and Asia for centuries. Burdock roots have been studied due to their widespread use in traditional Chinese medicine (TCM). The active ingredients in the root have been found to "detoxify" blood in TCM and promote blood circulation to the skin surface, improving skin quality and texture and treating skin diseases like eczema. The root contains antioxidant and antidiabetic compounds. Cutaneous eczema is a type of skin disease defined by inflammation. The most common manifestations are dermatitis, eczema, and urticaria. Common complications include erythema, blisters, and epidermal peeling. Because of its antioxidant and anti-inflammatory properties, quercetin may be beneficial in the treatment of cutaneous eczema. There are currently only a few studies on the use of antioxidant drugs transdermally to treat cutaneous eczema.

Objective:-

The goal of this study was to create quercetin-containing cream, evaluate their antioxidant properties, and test them in the skin of mice suffering from dermal eczema to see if they had preventive and therapeutic effects, with the hope of making them a new option for the treatment of cutaneous eczema. The findings suggested that had good antioxidant activity both in vivo and in vitro, making it potentially useful for the prevention and treatment of cutaneous eczema.

KEYWORDS:-

Burdock root, cutaneous eczema, quercetin, Stasis Dermatitis, Detoxification,

INTRODUCTION:-

Burdock: *Arctium lappa*, the scientific name for burdock, is a member of the Asteraceae family. It is a herbaceous, biennial plant that grows in North and North West Iran, as well as some regions of Europe and Asia. It has a thick, branched stem. [1] Starting from the end of the twentieth century, the majority of people in developed countries have become wealthier and more health conscious. They tend to spend extra money on different functional foods or nutraceuticals to pursue healthy aging. Natural products have been used in the treatment of various chronic human

pathological conditions because they are rich in antioxidants. The plant also contains flavonoids, and many researchers have demonstrated their role in treatment of diabetes [2] Some studies have mentioned the beneficial effect of Burdock on wound healing. [3] The dried root of 1-year-old burdock (Fig. 1) is the major part used for different therapeutic purposes, [4] it is suggested that the root of this herb is particularly effective and invaluable in eliminating heavy metals from our body. Therefore, it appears to have the function of draining toxins in terms of TCM theory. [5]

Burdock root contains chemical compounds including inulin, volatile oils, tannins, resin, sugar, iron, calcium, quercetin, arctigenin, and vitamin C. Furthermore, this flavonoids-containing plant has also remarkable antioxidant activities. Burdock contains different kinds of lignan compounds, notably lapazole C, F, A, matairesinol, arctigenin, arctinin, arctignan E. Arctin as a lignin has been found in the root and it can significantly reduce the elevated level of Malon dialdehyde (MDA) as a marker of oxidative stress (Chan et al., 2011)



Fig.1 Burdock.

Eczema:-

Eczema is a dermal disorder wherein blemish of skin begins dry, broken, and rough. Eczema is usually, chronic, non-contagious skin disorder. The main indication of this inflammatory disease is a very itchy rash. There is generally no cure for eczema, but it can be managed with consistent medical care and a systematic treatment plan. Some types of eczema can be prevented by avoiding stress, infliction, and belongings that cause allergic response. Eczema may produce potential for complications, such as a secondary bacterial or fungal infection of the eczema rash.

Eczema has been an engrossing challenge for it is proficient of remissions and worsening. Evidently, it is tough to circumvent the allergens entangled for the condition, more so in the underprivileged candidate of the disease. Nonetheless, it is valuable to dwell on the therapies available thus far to relieve the symptoms and signs. Although dermal corticosteroids are often used to manage the predominant symptoms of the ailment, the persistency of the situation increases the risk of everlasting unwanted effects. Herbal medicine is as old as civilization. Utilization of traditional herbal medicine is extensive in different province of the world. Herbal remedies are generally distinguished as effective and have fewer side effects. Many herbs are used to treat various dermal diseases including eczema. Among them is a burdock which has demonstrated great results in dermal diseases.



Fig.2 Eczema

Type of eczema: -

1. Atopic Dermatitis: (Persistent Red Patches)

The most common form of eczema is also a chronic one. "Sometimes it's worse, sometimes it's better, but it's always there". It usually starts in childhood, but adults can develop it too. Patients notice scaly patches, redness, inflammation, swollen skin, and sometimes open wounds, oozing, or crusting caused by scratching. Commonly affected areas include the elbows, knees, hands, feet, eyelids, and nipples.

Dermatologists suspect the condition stems from an overactive immune system combined with a difference in one's skin cells. "The skin is much drier and also everything in the environment such as allergens and irritants can get in more easily,"



Fig.3 Atopic Dermatitis

2. Seborrheic Dermatitis: (Dandruff)

It isn't usually thought of as eczema, but scalp dandruff falls in this category. Besides your head, you might also find greasy plaques and flakes on the eyebrows, nose, chest, or back. Doctors believe that in these cases, a yeast

that normally appears on the skin overgrows in gland-produced oils, causing the immune system to react.



Fig.4 Seborrheic Dermatitis

3. Contact Dermatitis: Itchy Redness

There are two types of contact dermatitis: irritant and allergic. Irritant is the redness that occurs on the skin's outermost layer after something like, say, wearing a bandage. In allergic contact dermatitis, the rash manifests as an immune response. One common example is poison ivy.



Fig.5 Contact Dermatitis

4. Stasis Dermatitis: Rash on Swollen Areas

This one usually happens in the elderly on the lower legs. As your circulation diminishes with time, you get fluid build-up. The immune system then tries to correct the swelling, but an over-response may also cause a crusty rash on top of the inflamed areas.



Fig.6 Stasis Dermatitis



Fig.7 Dyshidrotic Eczema

5. Dyshidrotic Eczema: Red Bumps on the Hands and Feet

Along with stasis, this type is less common. It usually crops up in the winter time on the hands and feet. You might develop red patches and pimple- or blister-like bumps on your fingers and toes.

Drug Profile

Active Drug - Quercetin

■ Generic Name - Quercetin

■ **Background** - Quercetin is a flavonol widely distributed in plants. It is an antioxidant, like many other phenolic heterocyclic compounds. Glycosylated forms include RUTIN and quercetrin.

■ **Description** - Plant pigment quercetin, or flavonol, is a strong antioxidant flavonoid that is mostly present in onions, grapes, berries, cherries, broccoli, and citrus fruits. It is a multipurpose antioxidant that has been shown to have protective properties against tissue damage brought on by a range of drug toxicity.

■ Structure

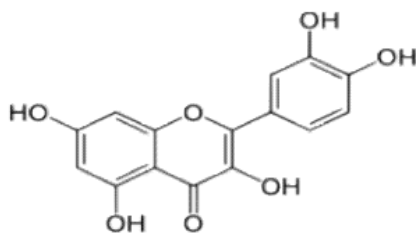


Fig: Quercetin

Chemical Formula- C₁₅H₁₀O₇

Synonyms	3'-Hydroxy Kaempferol, Sophoretin, Xanthaurine.
IUPAC Name	2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxy-4H-chromen-4-one

BCS classification	Class II drug.
Molecular Weight	302.2357g/mol
Mechanism of action	Quercetin can regulate the Th1/Th2 stability, and decrease the antigen-specific IgE antibody releasing by B cells.
Melting Point	601to603°F(316-318 °C).
Solubility in other solvent	Very soluble in ether, methanol; soluble in ethanol, acetone, pyridine, acetic acid.
Water solubility	60mg/L(at16°C)
Density	1.799g/cm ³
Partition coefficient	1.82±0.32.

Excipients Profile

1. Glycerin

Generic Name-Glycerin

Background - A trihydroxy sugar alcohol that is an intermediate in carbohydrate and lipid metabolism.

Structure

Fig: Glycerin

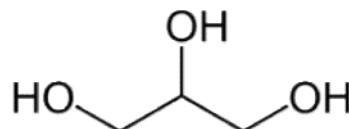


Fig: Glycerin

1 Chemical Formula- $C_3H_8O_3$

Synonyms	Trihydroxypropane
IUPAC Name	Propane-1,2,3-triol
Chemical Weight	92.0938
Melting point	18.2°C
Solubility	Very soluble in water
Density	1.26g/cm ³

2. Cetearyl Alcohol

Generic Name-Cetearyl Alcohol

Background - Cetearyl alcohol is a chemical found in cosmetic products. It's a white, waxy mixture of cetyl alcohol and stearyl alcohol, both fatty alcohols.

■ Structure

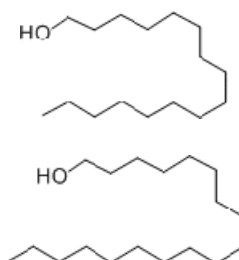


Fig: Cetearyl Alcohol

1 Chemical Formula: $C_{18}H_{38}O.C_{16}H_{34}O$

Synonyms	Cetostearyl alcohol, Cetylstearyl alcohol
Chemical Weight	512.941

Melting point	51 -53°C
Solubility	Practically insoluble in water, soluble in ethanol(96percent)and in light petroleum.When melted ,it is miscible with fatty oils,with liquid paraffin and with melted wool fat.
Density	0.8[at20°C]
LogP	6.73at25°C

3.Palm Oil

■ Generic Name - Palm Oil

■ **Background** - Palm oil is a plant/plant extract used in some OTC (over-the-counter) products.

■ **Description** - Palm oil is a type of vegetable oil derived from the fruit of the oil palm tree, scientifically known as *Elaeis guineensis*.

■ Structure

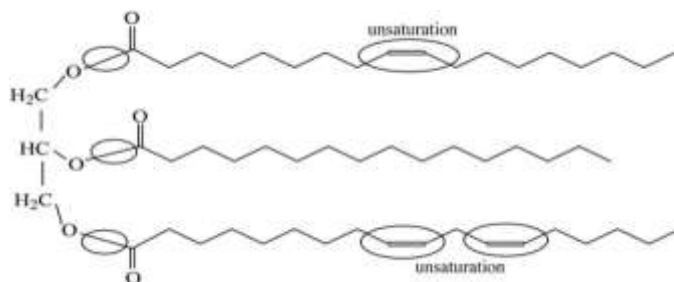


Fig: Triglyceride molecule of palm oil

1 Chemical Formula-C₅₅H₉₈O₆

Synonyms	African Palm Oil, Palm butter, Golden Palm oil
Melting point	30-40 °C(lit.)
Density	0.89-0.92g/mL

Solubility	ethanol, ether, chloroform, carbon disulfide
LogP	1.8

4.Coconut Oil

I Generic Name-Coconut oil

I Background- Coconut oil is a versatile and popular oil derived from the kernel, or meat, of mature coconuts harvested from the coconut palm (*Cocos nucifera*).

I Structure

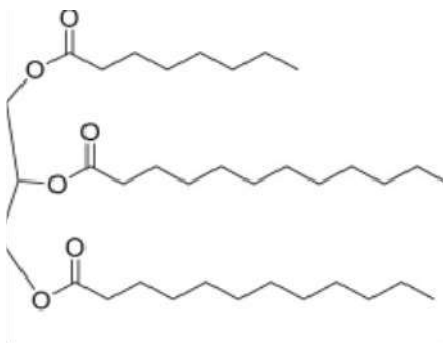


Fig: Coconut oil

I Chemical formula-C₁₂H₂₄O₆

Synonyms	Coconut Oil Triglycerides, Cocos Nucifera Seed Oil
Meltingpoint	20-28°C
Density	0.903g/mL at 25°C
Solubility	Practically insoluble in water, freely soluble in methylene chloride and in light petroleum, very slightly soluble in ethanol

5. Shea Butter

I Generic Name- Shea butter

I Background- Shea butter is a plant/plant extract used in some OTC (over-the-counter) products. It is not an approved drug.

I Description- Shea butter is a fat (triglyceride; mainly oleic acid and stearic acid) extracted from the nut of the African shea tree.

I Structure

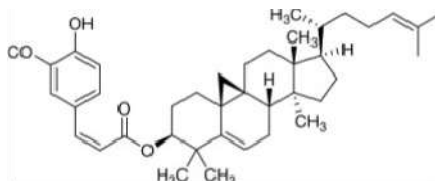


Fig: Shea Butter

I Chemical formula-C₅₅H₁₀₄O₆

Synonyms	Butyrospermum Parkii, Shea Tree Seed Fat
IUPAC Name	(2S,3S)-2,3-dihydroxybutanedioic acid butyl ester
Molecular Weight	861.382g/mol.
Melting point	32°C to 45°C (89.6°F to 113°F)
Density	0.91 to 0.94g/cm ³
Solubility	Insoluble in water, soluble in ethanol, chloroform, or hexane

6. Beeswax

I Generic Name- Beeswax

I Background - Beeswax is a product made from the honeycomb of the honeybee and other bees.

I Description- Beeswax is generally available as yellow, white, or bleached. Yellow beeswax comes directly from the honeycomb, while white and bleached beeswax come from yellow beeswax.

Melting Point	62°C-64°C(144°F-147°F)
Solubility	Insoluble in water, partially soluble in hot ethanol, completely soluble in fatty and essential oils.
Density	0.960

Samples extraction

Extracting quercetin from burdock root involves several steps:

Step-1: Preparation of burdock root



Clean and chop burdock root into small pieces.

Step-2: Extraction solvent



Choose ethanol or methanol as the extraction solvent.

Step-3: Extraction process



Macerate burdock root in solvent for days to weeks with occasional agitation.

Step-4: Filtration



Filter the mixture to separate liquid extract from solid plant material.

Step-5: Concentration



Concentrate the extract using methods like evaporation or rotary evaporation.

Step-6: Purification



Purify the extract, potentially using chromatography techniques.

Step-7: Storage



Store the purified quercetin extract in a cool, dark place for long-term preservation.

Purpose: -

- Burdock's anti-inflammatory properties are one of the most important reasons for using it to treat eczema. Eczema is characterized by skin inflammation, which causes symptoms like redness, itching, and swelling.
- Burdock contains compounds such as arctigenin and lignans, which have been shown to have anti-inflammatory properties. These compounds may help reduce inflammation in the skin, thus alleviating symptoms of eczema and promoting healing.
- Burdock is known for its antioxidant properties as well as its anti-inflammatory effects. Antioxidants protect the skin from free radical damage, which can exacerbate inflammation and contribute to skin conditions such as eczema. Burdock, which scavenges free radicals, may help prevent oxidative stress and improve overall skin health.
- Furthermore, burdock is thought to detoxify the body. It contains compounds that help the liver function and eliminate toxins from the body.
- New research suggests a link between gut health and skin conditions such as eczema, and maintaining a healthy gut microbiota balance may help alleviate eczema symptoms. Burdock may indirectly support skin health by encouraging the growth of beneficial bacteria in the gut, reducing the severity of eczema symptoms.

Advantages: -

Burdock offers several potential advantages due to its nutritional content and bioactive compounds. Here are some of the key benefits:

- 1. Rich in Antioxidants:** Burdock root is packed with antioxidants like phenolic acids, quercetin, and luteolin. These compounds help protect your cells from damage caused by free radicals, which may reduce the risk of chronic diseases like cancer and heart disease.
- 2. Anti-inflammatory Properties:** Burdock contains anti-inflammatory compounds that may help reduce inflammation in the body. This could be beneficial for conditions like arthritis, acne, and inflammatory skin conditions.
- 3. Supports Digestive Health:** Burdock root has long been used in traditional medicine as a digestive aid. It contains inulin, a type of soluble fiber that acts as a prebiotic, promoting the growth of beneficial gut bacteria. This can improve digestion and support overall gut health.
- 4. May Lower Blood Sugar Levels:** Some studies suggest that burdock root may help lower blood sugar levels, making it potentially beneficial for people with diabetes or those at risk of developing the disease. However, more research is needed in this area.
- 5. Detoxification:** Burdock root is often used in traditional medicine as a blood purifier and detoxifying agent. It is believed to help remove toxins from the blood and promote the elimination of waste through the kidneys and liver.

Disadvantages: -

While burdock offers several potential health benefits, there are also some potential disadvantages and risks considering:

- 1. Allergic Reactions:** Some individuals may be allergic to burdock. If you have a known allergy to plants in the Asteraceae family (such as ragweed, daisies, or chrysanthemums), you may also be allergic to burdock.
- 2. Interactions with Medications:** Burdock may interact with certain medications, including blood thinners, diuretics, and diabetes medications. If you are taking any medications, it's important to consult with a healthcare professional before using burdock to avoid potential interactions.
- 3. Pregnancy and Breastfeeding:** There is limited research on the safety of burdock during pregnancy and breastfeeding. It's best to avoid using burdock if you are pregnant or breastfeeding unless under the supervision of a healthcare provider.
- 4. Digestive Issues:** While burdock is often used to support digestive health, some individuals may experience digestive issues such as gas, bloating, or diarrhea when consuming burdock root or supplements. It's recommended to start with a small amount to assess tolerance.
- 5. Blood Sugar Levels:** While some studies suggest that burdock may help lower blood sugar levels, it could potentially cause hypoglycemia (low blood sugar) in individuals taking diabetes medications or those with diabetes. Monitoring blood sugar levels closely is advised.

Formulation

Main ingredient	
Ingredient	Example
Antioxidant	Arctium Lappa Extract
Exfoliant	Lactic Acid
Skin-identical ingredient	Glycerin
Soothing	Arctium Lappa Extract, Cetraria Islandica Extract, Foeniculum Vulgare Oil
Other Ingredients	
Antimicrobial/antibacterial	Alcohol
Buffering	Lactic Acid

Emollient	Prunus Amygdalus Dulcis Oil, Glyceryl Stearate, Cetearyl Alcohol, Cetyl Alcohol, Borago Officinalis Seed Oil, Cetraria Islandica Extract, Lavandula Hybrida Oil, Foeniculum Vulgare Oil
Emulsifying	Glyceryl Stearate, Cetearyl Alcohol, Polyglyceryl-6 Distearate
Moisturizer/humectant	Glycerin, Lactic Acid
Solvent	Aqua, Alcohol
Surfactant/cleansing	Potassium Palmitoyl/Hydrolyzed Wheat Protein, Cetearyl Alcohol, Cetraria Islandica Extract
Viscosity controlling	Alcohol, Cetearyl Alcohol, Cetyl Alcohol, Solum Fullonum, Xanthan Gum

Formulation Table

Ingredient	Quantity in percentage(%)
Burdock extract	1-3%
Purified water	60-70%
Glycerin	2-5%
Palm oil	5-10%
Coconut oil	5-10%
Glyceryl monostearate	2-5%
Beeswax	1-3%
Cetearyl alcohol	2-5%
Phenoxyethanol	0.5-1%
dimethicone	1-3%

carbomer	0.12-0.5%
Vitamin E	0.12-0.5%
Sodium citrate	0.12-0.5%
Shea butter	5-10%

Preparation

Prepare Water Phase:

- Mix purified water and glycerin together.
- Add the burdock 4:1 extract to the water-glycerin mixture and stir until dissolved.

Preparation Oil Phase:

- In a separate container, combine palm oil, coconut oil, shea butter, glyceryl monostearate, beeswax, and sunflower seed oil.
- Heat the oil phase gently until all ingredients are melted and well mixed.

Combine Phases:

- Slowly add the water phase to the oil phase while stirring continuously. This is best done using a high-shear mixer or homogenizer to ensure thorough emulsification.

Cooling and Thickening:

- Continue stirring as the mixture cools down to around 40–45°C.
- Add dimethicone, carbomer, and vitamin E to the mixture and continue stirring until fully incorporated.

Preservation:

- Add phenoxyethanol to act as a preservative. Ensure it's evenly distributed throughout the mixture.

Adjust pH:

- Use sodium citrate to adjust the pH of the cream to the desired level. The typical pH for a cream is around 5.5, which is close to the skin's natural pH.

Homogenization and Cooling:

- Homogenize the cream to ensure uniform texture and stability.
- Allow the cream to cool down completely while continuing to mix gently.

Packaging:

- Once cooled, transfer the cream into suitable packaging, such as jars or tubes, for storage and use.

Chemical evaluation

1. Extraction of Active Compounds

■ The first step involves extracting the active compounds from the burdock root. This can be done using solvents like ethanol or water, or through methods like maceration or Soxhlet extraction.

2. Identification of Compounds

■ Once extracted, the compounds need to be identified. This can be done using various analytical techniques such as chromatography (HPLC, GC), spectroscopy (UV-Vis, FTIR), or mass spectrometry. Each technique can identify different types of compounds.

3. Quantification of Compounds

■ After identification, the next step is quantification. This involves determining the concentration of each compound present in the cream. Quantification can be achieved using calibration curves with known standards or internal standards.

4. Quality Control

■ Ensuring consistency and quality of the cream is essential. This involves testing for contaminants, such as heavy metals, pesticides, or microbial contamination. It also involves assessing physical characteristics like texture, color, and odor.

5. Stability Testing

■ Evaluating the stability of the cream over time is crucial. This involves storing the cream under different conditions (temperature, humidity) and periodically testing its chemical composition to ensure it remains effective and safe for use.

Conclusion: -

In Conclusion, the formulation and evaluation of the burdock root-based cream for eczema treatment have yielded promising results. Eczema is a dermal disorder. Burdock (*Arctium lappa*) showed anti-inflammatory properties due to the presence of quercetin, which possesses antioxidant and anti-inflammatory properties. These are the most important reasons for using it to treat eczema.

Burdock root-based cream was formulated according to a standard parameter of a cream. Evaluation of the cream was done morphologically, biologically, chemically, and physically. The cream exhibited a beige to brown color, indicative of the natural color of burdock root extract, and demonstrated favorable consistency and spreadability. Microscopic examination confirmed the presence of plant cell structures characteristic of burdock root extract, ensuring uniform distribution throughout the cream. Particle size analysis and rheological evaluation provided insights into stability and application properties. Biological evaluation revealed the cream's anti-inflammatory, antioxidant, and wound healing properties, along with its antimicrobial activity, highlighting its potential as an effective therapeutic option for eczema. Chemical evaluation confirmed the presence and quantification of active compounds, ensuring consistency and quality. Physical evaluation showed minimal irritancy, good washability property, and pH and viscosity in an acceptable range.

These evaluations collectively ensured that the burdock root-based cream met the necessary criteria for usability and stability, crucial for its effectiveness and safety in eczema treatment.

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