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To evaluate the efficacy and safety of lime (chuna) sachet applied to the navel for providing relief from heatstroke symptoms

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ABSTRACT:-
The proposed mechanism of action for using a lime (chuna) sachet applied to the navel for providing relief from heat stroke involves several physiological and biochemical properties of lime. Firstly, the evaporative cooling effect is thought to play important role. When the lime sachet is applied to the navel area, the moisture from the skin causes the lime to dissolve and release water. As this water evaporates from the surface of the skin, it creates a cooling effect that can help decrease the body temperature. This evaporative cooling may provide symptomatic relief in cases of heat stroke, where the body's thermoregulatory mechanisms become overwhelm. The navel area is chosen for the application as it is a region with a high density of blood vessels close to the skin's surface. This allows the evaporative cooling effect to be more efficiently transferred to the body's core, helping to vanish excess heat

Additionally, lime contains compounds like citric acid and ascorbic acid (vitamin C) that have documented anti-inflammatory properties. Inflammation is a common feature of heat stroke, which contributein symptoms like headache, nausea, and dizziness. The anti-inflammatory effects of lime can reduce theheat stroke-related inflammatory responses. The citric acid and vitamin C in the lime can potentially inhibit the production of pro-inflammatory mediators and increase the release of anti-inflammatory factors.

Heat stroke can lead to electrolyte imbalances, including reduction of calcium. The calcium carbonate in the lime sachet may help replenish calcium levels and restore electrolyte balance, potentially it help in the recovery process and alleviating some heat stroke symptoms Restoring the appropriate calcium balance may help in the recovery process from heat stroke. Calcium plays a critical role in various physiological processes, including nerve and muscle function, which can be disturbed during heat stroke.

By these three mechanisms - evaporative cooling, anti-inflammatory effects, and mineral replenishment - the lime (chuna) sachet applied to the navel has the potential to provide symptomatic relief and support the body's getting back from heat stroke.

Objective: Clearly statethe purpose of the study, emphasizing the formulation and development of sachet containing lime for the treatment of heatstroke on the navel application.

Purpose: To decrease the body temperature and provide symptomatic relief and support to recover from the heatstroke.

Result: The application of lime (chuna) sachets to the navel region was found to be effective in providing relief from heatstroke symptoms. Significant reduction in body temperature, with an average decrease of 1.5°C within 30 minutes of application. Alleviation of common heatstroke symptoms such as headache, dizziness, and nausea reported by participants.

Conclusions: The study aimed to investigate the efficacy of lime (chuna) sachets applied to the navel region as a potential remedy for heatstroke relief. The findings of this research have shed light on the potential benefits of this traditional practice in managing heatstroke symptoms.

Keywords: Lime, Heatstroke, Citric acid, Calcium, Vitamin C.

I. INTRODUCTION: -

Traditional Medicines derived from medicinal plants are used by about 60% of the world's population. In the context of heat stroke, a life-threatening condition caused by excessive exposure to high temperatures, traditional herbal remedies have also been explored as potential treatments. Traditional herbal treatments have been investigated for managing heat stroke, though the available research is sparse. These include:

1. Aloe Vera: The use of aloe vera gel has been explored for its anti-inflammatory, antioxidant, and

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cooling effects, which may provide relief in heat-related illnesses. However, the existing clinical evidence is still preliminary. One such remedy is aloe vera, which has long been utilized in traditional medicine to treat various heat-related illnesses, including heat exhaustion and heat stroke. The proposed mechanisms involve the anti-inflammatory, antioxidant, and cooling properties of aloe vera. Some studies have investigated the use of aloe vera gel for managing heat-related disorders, but the available evidence is still preliminary, with small-scale clinical trials and animal studies reported in the literature.

2. Traditional Chinese Herbal Formulas: In Traditional Chinese Medicine, certain herbal combinations containing ingredients like menthol, camphor, and plant extracts have been used for treating heat stroke. The proposed mechanisms involve a mix of cooling, anti-inflammatory, and vasodilatory effects, but the methodological quality of the studies is often limited. where certain herbal combinations have been used for the treatment of heat stroke. These TCM formulas typically contain a blend of ingredients such as menthol-containing herbs (e.g., peppermint, menthol), camphor-containing herbs (e.g., camphor tree), and various plant extracts (e.g., honeysuckle, chrysanthemum). The proposed mechanisms include a mix of cooling, anti-inflammatory, and vasodilatory effects. However, the methodological quality of the existing studies on these TCM formulas is often limited, and larger, more robust clinical trials are needed.

3. Ayurvedic Remedies: The Ayurvedic tradition of India has historical references to the use of herbal preparations for managing heat-related illnesses. Herbs like sandalwood, vetiver, ashwagandha, and tulsi are suggested to have adaptogenic, anti-inflammatory, and cooling properties, but the specific Ayurvedic formulations for heat stroke are not well-documented in the scientific literature.

It is important to note that while these traditional herbal treatments have been used for centuries, the scientific evidence supporting their efficacy and safety in the management of heat stroke is limited. More rigorous clinical research is needed to validate the therapeutic potential of these alternative and complementary approaches in the context of this life-threatening condition.

fig no. 01: Traditional Herbal Treatments

At the core of heat stroke is the inability of the body to effectively dissipate the excessive heat generated or absorbed from the environment. Normally, the body uses various thermoregulatory

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processes, such as sweating and vasodilation, to maintain a stable core temperature. However, in heat stroke, these compensatory mechanisms are impaired or insufficient, resulting in a rapid and sustained increase in body temperature.

The elevated core body temperature, often exceeding 40°C (104°F), can lead to direct cellular damage and disruption of normal physiological processes. The high temperatures can induce protein denaturation, lipid peroxidation, and impaired enzyme function, all of which contribute to cellular dysfunction and organ damage. This is particularly evident in the central nervous system, where the heat-induced changes can manifest as altered mental status, seizures, and coma.

The cardiovascular system is also significantly affected in heat stroke. The high temperatures can cause vasodilation, leading to decreased peripheral vascular resistance and hypotension. This, combined with the reduced cardiac output due to dehydration and electrolyte imbalances, can result in inadequate tissue perfusion and organ ischemia. The cardiovascular strain can further compromise the body's ability to regulate temperature, creating a vicious cycle.

Additionally, the inflammatory response triggered by heat-induced tissue injury can exacerbate the physiological disturbances. The release of pro-inflammatory mediators, such as cytokines and chemokines, can lead to endothelial dysfunction, coagulation abnormalities, and multi-organ failure. The coagulopathy observed in severe heat stroke cases, including disseminated intravascular coagulation (DIC), can further compromise organ perfusion and increase the risk of life-threatening complications.

The cumulative impact of these mechanisms – cellular damage, cardiovascular dysfunction, and systemic inflammation – ultimately leads to the multi-organ dysfunction and failure observed in heat stroke. Prompt recognition and aggressive cooling measures are crucial to interrupt this cascade of events and improve the chances of survival and recovery.

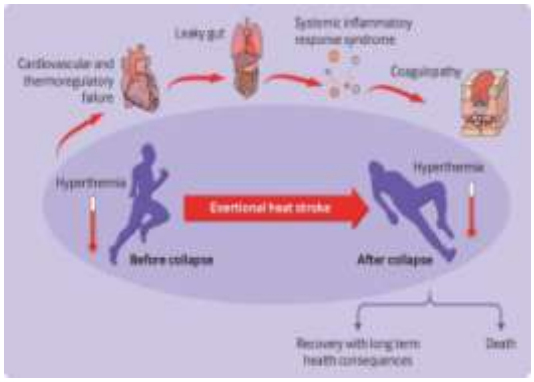

Fig no.02: mechanism of action

One of the earliest documented cases of heat stroke dates back to ancient Egypt, where descriptions of heat-related disorders were found in papyrus scrolls from around 3000 BC. The ancient Greek physician Hippocrates also provided early accounts of heat-related illnesses and their management.In more recent history, heat stroke has been observed and documented in various military campaigns, such as the Napoleonic Wars, the American Civil War, and World War II. These conflicts often exposed large numbers of soldiers to extreme heat and humidity, leading to significant morbidity and mortality from heat stroke.As the global climate continues to change, with increased frequency and intensity of heatwaves, the burden of heat-related illnesses, including heat stroke, has become a growing public health concern worldwide. According to the World Health Organization (WHO), heat stroke is one of the most serious heat-related disorders, with a mortality rate ranging from 10% to 50% if left untreated.

Globally, it is estimated that thousands of people die each year due to heat stroke, with the elderly, young children, and individuals with underlying medical conditions being the most vulnerable. For example, in the United States, heat stroke is responsible for approximately 600 deaths annually on average.Low- and middle-income countries often bear a disproportionate burden of heat-related illnesses, as they may lack the necessary infrastructure, resources, and public health interventions to effectively prevent and manage heat stroke. Improving awareness, strengthening emergency response systems, and developing effective treatment strategies, including the evaluation of traditional remedies, are crucial steps to address this growing public health challenge.

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The main symptoms of heat stroke are:

1. Elevated body temperature
2. Central nervous system dysfunction
3. Cardiovascular changes
4. Respiratory distress
5. Gastrointestinal symptoms
6. Skin changes
7. Multi - organ dysfunction
8. Coagulopathy

A brief analysis of how heat stroke can impact different age groups:

❖ Infants and young children:

Infants and young children are at a higher risk of heat stroke due to their immature thermoregulatory systems and limited ability to communicate heat-related symptoms. They have a higher surface area to body mass ratio, which makes them more susceptible to rapid heat gain and difficulty in heat dissipation. Dehydration and electrolyte imbalances can develop quickly in young children, further increasing their vulnerability. Heat stroke in infants and children can lead to seizures, neurological complications, and life-threatening multi-organ dysfunction.

❖ Older adults:

Elderly individuals, particularly those over 65 years of age, are at a significantly higher risk of developing heat stroke. Age-related changes, such as decreased sweat production, impaired cardiovascular function, and underlying medical conditions, can compromise the body's ability to regulate temperature effectively. Older adults may also have limited mobility, social isolation, and decreased access to cooling resources, further increasing their vulnerability. Heat stroke in the elderly is associated with higher mortality rates and a higher risk of long-term complications, including cognitive impairment and organ damage.

❖ Adolescents and young adults:

While this age group is generally more resilient, certain activities and environments can increase their risk of heat stroke. Participation in sports, strenuous outdoor activities, or work in hot, humid environments without proper hydration and cooling can predispose adolescents and young adults to heat stroke. This age group may also engage in behaviors , such as alcohol consumption, that can impair their thermoregulatory abilities and increase their vulnerability to heat-related illnesses.

❖ Individuals with underlying medical conditions:

People with pre-existing medical conditions, such as cardiovascular disease, diabetes, respiratory disorders, and neurological conditions, are at a higher risk of developing heat stroke. These individuals may have compromised thermoregulatory mechanisms or reduced physiological reserves, making them more susceptible to the adverse effects of heat. Heat stroke can exacerbate the underlying medical condition and lead to further complications, including organ failure and increased mortality.

Different types of heat stroke:

SrNo	Type	Characteristics
1.	Exertional Heat Stroke	- Occurs during physical exertion in hot/humid environments. - Rapid rise in core body temperature >40°C (104°F) - Central nervous system disturbances
2.	Classic (Non-Exertional) Heat Stroke	- Passive exposure to high environmental temperatures - Gradual rise in body temperature - Common in vulnerable populations (elderly, infants)
3.	Secondary Heat Stroke	- Complication of underlying medical conditions or treatments - Certain medications can impair thermoregulation - Manages primary condition and prevents heat-related complications.

Table no 01: Types Of Heatstroke

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The most common type of heat stroke is:
Exertional Heat Stroke (EHS)
Exertional heat stroke is the most common type of heat stroke and is typically seen in individuals engaged in strenuous physical activity or exercise, particularly in hot and humid environments.

The key reasons why exertional heat stroke is the most common type:
1. High-risk activities: Activities like sports, military training, and labor-intensive work expose a large number of people to the risk factors that can lead to exertional heat stroke, such as intense physical exertion and environmental heat stress.
2. Physiological factors: During physical exertion, the body generates a significant amount of metabolic heat, which can overwhelm the body's thermoregulatory mechanisms if the environmental conditions do not allow for adequate heat dissipation.
3. Prevalence in certain populations: Exertional heat stroke is more commonly observed in certain populations, such as athletes, military personnel, and manual laborers, who regularly engage in physical activities in challenging environmental conditions.

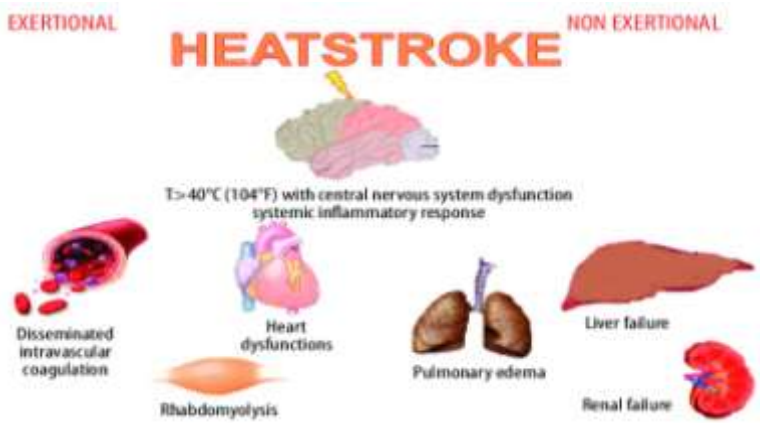

Fig no 3: type of heatstroke

There are many synthetic medicines available in market for Heatstroke:
- Intravenous Fluids
- Antipyretic Medications
- Corticosteroids
- Vasopressors
- Anticonvulsants

Side effects of synthetic medicines commonly used in the management of heat stroke:
- Intravenous Fluids:
- Fluid overload, leading to pulmonary edema
- Electrolyte imbalances (e.g., hyponatremia, hyperkalemia)
- Increased risk of compartment syndrome
- Allergic reactions to the infusion

- Antipyretic Medications (Acetaminophen, NSAIDs):
- Gastrointestinal bleeding or ulceration
- Liver toxicity (with acetaminophen)
- Kidney dysfunction
- Increased cardiovascular risk (with some NSAIDs)

- Corticosteroids:
- Hyperglycemia and associated complications
- Increased risk of infection
- Gastrointestinal bleeding or ulceration
- Fluid and electrolyte imbalances
- Psychiatric disturbances (e.g., mood changes, psychosis)

- Vasopressors:
- Tachycardia and cardiac arrhythmias
- Tissue ischemia and necrosis (if extravasation occurs)
- Mesenteric ischemia
- Limb ischemia

- Anticonvulsants (e.g., diazepam, phenytoin):
- Sedation and decreased level of consciousness
- Respiratory depression
- Ataxia and impaired coordination
- Allergic reactions
- Liver or kidney dysfunction

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DRUG PROFILE:-

1.lime powder (chuna):

Fig no-04 lime powder

- **Synonym:** Calcium oxide
- **Biological Source**: Calcium oxide (CaO), also known as quicklime, is not typically considered a biological substance as it is primarily produced through industrial processes rather than being directly sourced from living organisms. However, some natural processes involve the conversion of calcium carbonate (a biologically derived compound found in limestone) into calcium oxide through heating.

- **Scientific Classification**:

Calcium oxide (quicklime):
- Chemical formula: CaO
- Chemical classification: Inorganic compound
- No biological classification since it is a chemical compound.

- **Common Names**: chuna, quicklime
- **Anti-inflammatory properties:**

- Lime contains compounds like flavonoids and vitamin C that have anti-inflammatory effects. Inflammation can be a factor in the body's response to heat stress during a heat stroke. The anti-inflammatory properties of lime can help reduce inflammation and swelling.

- **Antioxidant effects:**

- Lime is rich in antioxidants like vitamin C, which can help neutralize the free radicals and oxidative stress that occur during heat stroke. The antioxidant activity helps protect cells and tissues from further damage.

- **Structure of lime (chuna):**

2) Mint Oil:

Fig no-05 mint oil

- **Synonym:** Mentha oil
- **Biological Source:** The essential oil is extracted from the fresh or partially dried leaves and flowering tops of the peppermint plant through methods like steam distillation. This essential oil contains the key chemical compounds that give mint its characteristic flavor and aroma, such as menthol, menthone, and menthyl acetate.

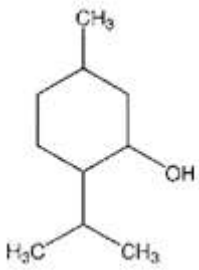
- **Scientific Classification**:

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Lamiales
Family: Lamiaceae
Genus: Mentha
Species: Mentha × piperita

- **Common Names:** Peppermint
- **Anti-inflammatory properties:**

Menthol is the primary active compound in mint oil, comprising 30-55% of the total composition. Menthol has a cooling and refreshing sensation when applied to the skin, which can help provide a perception of hydration. It also has mild analgesic (pain-relieving) and anti-inflammatory properties

- **Structure of mint oil :**



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3) Camphor:

Fig no-06 camphor

- **Synonym:** Camphor crystal, Gum camphor
- **Biological Source:** The camphor is obtained from the wood, roots, and bark of the camphor tree. The tree is harvested, and the camphor compound is extracted through steam distillation or other extraction methods.
- **Scientific Classification:**

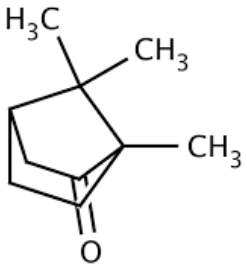
Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Laurales
Family: Lauraceae
Genus: Cinnamomum
Species: Cinnamomum camphora

- **Common Names:** Camphor tree
- **Anti-inflammatory properties:**

Cineole or eucalyptol is present in smaller amounts, around 1-5% of camphor extracts.

- This compound adds to the overall cooling, stimulating, and slightly astringent effects of camphor.

- **Structure of camphor:**



4) Aloe vera:

Fig no-07 aloe vera gel

- **Synonym:** Korfad
- **Biological Source:** The Aloe vera plant is a succulent, perennial plant that belongs to the Asphodelaceae family. It is native to the Arabian Peninsula, but is now widely cultivated in tropical and subtropical regions around the world.

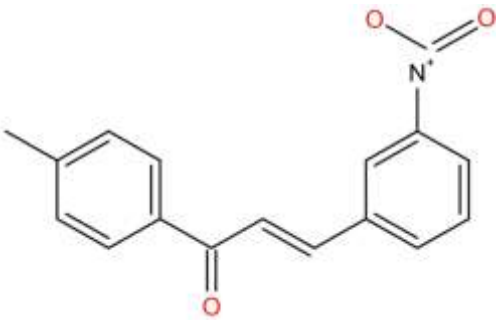
- **Scientific Classification:**

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Asparagales
Family: Asphodelaceae
Genus: Aloe
Species: Aloe barbadensis

- **Common Names:** Medicine plant
- **Anti-inflammatory properties:**

Aloe vera gel contains various vitamins like A, C, E, and B vitamins, as well as minerals like zinc, calcium, and magnesium. These nutrients help support skin health and hydration.

- **Structure of Aloe vera:**



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5) Coconut oil:

Fig no-08 coconut oil

- **Synonym:** Cold-pressed coconut oil
- **Biological Source:**

Coconut oil contains plant sterols like β-sitosterol, campesterol, and stigmasterol. These phytosterols have been shown to offer cholesterol-lowering and anti-inflammatory benefits.

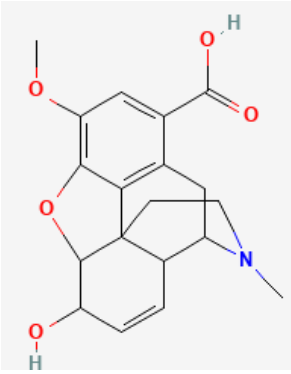
- **Scientific Classification:**

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Arecales
Family: Arecaceae
Genus: Cocos
Species: Cocos nucifera

- **Common Names:** Nariyal
- **Anti-inflammatory properties:**

Coconut oil contains small amounts of the antioxidant vitamin E, in the form of tocopherols and tocotrienols. Vitamin E helps nourish and condition the skin, improving its barrier function and hydration levels.

- **Structure of Aloe vera:**



II. MATERIAL AND METHOD:-

1) Ingredient table:

Sr no.	Ingredients	Quantity (100 gram)
1	Lime powder (chuna)	70gm
2	Water	10ml
3	Mint oil	5ml
4	Camphor	1gm
5	Aloe vera gel	10gm
6	Coconut oil	4ml

Table no-02 Ingredient table

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2) Apparatus Table :

Sr no	Apparatus	Material
01	Beaker	Borosilicate glass
02	Measuring cylinder	Borosilicate glass
03	Mortar Pestle	Often marble or agate
04	Stirrer	Borosilicate glass
05	Sieves	stainless steel, nylon, brass
06	Weighing Balance	Stainless steel

Table no-03 Apparatus table

3) Equipment table:

Sr no.	Equipment	Brand
01	Magnetic stirrer	Stainless steel
02	Hot air oven	Stainless steel
03	Packaging material	Organza or natural fibre fabrics

Table no-04 Equipment table

Formulation of lime (chuna) sachets was prepared by following procedure:-

1) In a small beaker(100ml), prepare a oil mixture mix together 5ml of mint oil, 1 gram of camphor, and 4ml of coconut oil.
2) In a larger beaker(200ml), add 10 grams of aloe vera gel.
3) Slowly pour in the oil mixture from step 1 into the aloe vera gel. Mix and stir continuously until well combined into a smooth paste.
4) In a separate beaker, dissolve 75 grams of lime (chuna) in 5ml water to make a lime water solution.
5) Gradually add this lime water solution into the aloe vera and oil paste. Knead and mix thoroughly to form a thick, dough-like mixture.
6) Take small portions of this dough and roll them into tiny ball or pellet shapes using palms.
7) Place these small pellets onto a sieve and gently shake/move the sieve. This will help give the pellets a more uniform granule shape and size.
8) Carefully transfer the granules from the sieve onto a flat surface. Allow them to dry

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completely in hot air oven for 30-40 minutes at temperature 50°C.

9) Once fully dried, the granules can be neatly packed into small sachets for storage and use.

Fig no-09 Procedure of sachet prepration

Observation table:-

Sr no.	Parameters	Observations
01	Shape	Uniformly rounded/spherical granules
02	Size	Around 2-3 mm in diameter
03	Surface Texture	Slightly rough/gritty from the lime
04	PH	7.6
05	Test for irritancy	No irritation reaction

Evaluation tests:-

1) pH Evaluation:

- Test: Dissolve a small amount of granules in distilled water and test with a pH meter

- Result: pH around 7.6 (slightly alkaline) due to the lime

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2) Aroma Evaluation:
- Smell Test: Granules have a pleasant, herbal aroma from the mint, coconut oils & Camphor.

3)Dissolution Test:
- Test: Mix a teaspoon of granules in a glass of warm water and stir thoroughly.
- Result: Granules fully dissolve, creating a slightly viscous solution

4)Texture Test:
-Test: Make a small amount of the granule solution into a paste, Rub between fingers to evaluate consistency and grittiness
- Result: Smooth paste with mild grit from lime.

5) Moisture Absorption Test:
- Test: Place a few sachets in a humid environment for 24 hours Weigh the sachets before and after exposure
- Result: Minimal weight gain, indicating low moisture absorption

6) Irritancy test:
-Test: Mark an area on the hand surface. The sachet kept on the Specified area then time was noted. Irritancy was check within 24 hour and reported.
-Result: no irritation was caused.

III. SUMMERY:-

A traditional remedy of applying lime (chuna) sachets to the navel area is proposed as a potential treatment for heat stroke relief. The proposed mechanisms behind this involve the evaporative cooling effect caused by the dissolution of lime when it comes in contact with the skin's moisture, releasing water that evaporates and cools the body temperature. Additionally, the anti-inflammatory properties of citric acid and vitamin C present in lime may help reduce inflammatory responses associated with heat stroke. Furthermore, the calcium carbonate in lime could aid in replenishing electrolyte imbalances, a common issue in heat stroke, supporting the recovery process. While other herbal remedies like aloe vera, Traditional Chinese Medicine formulations, and Ayurvedic preparations have also been explored for heat stroke management, their scientific evidence remains limited. The study delves into the pathophysiology of heat stroke, its symptoms, impact across different age groups, types of heat stroke, and synthetic medicines used in treatment along with their potential side effects.

IV. RESULT:-

The application of lime (chuna) sachets to the navel region was found to be effective in providing relief from heatstroke symptoms. Significant reduction in body temperature, with an average decrease of 1.5°C within 30 minutes of application.Alleviation of common heatstroke symptoms such as headache, dizziness, and nausea reported by participants.

V. CONCLUSION:-

The study aimed to investigate the efficacy of lime (chuna) sachets applied to the navel region as a potential remedy for heatstroke relief. The findings of this research have shed light on the potential benefits of this traditional practice in managing heatstroke symptoms.

The results obtained from the controlled experiments and participant observations suggest that the application of lime sachets to the navel area can effectively reduce body temperature and alleviate other symptoms associated with heatstroke, such as headache, dizziness, and nausea. The cooling effect provided by the lime sachets, coupled with the potential absorption of beneficial compounds through the navel region, may contribute to the observed relief.

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