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Formulation and Evaluation of Analgesic and Anti-inflammatory Cream by Using Black Pepper, Turmeric and Menthol.

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ABSTRACT:-

Growing interest in the development of topical formulations has been on natural chemicals because of their potential therapeutic benefits and low side effects. Menthol, turmeric are major active ingredients used in this present research in developing and assessment of an analgesic and anti-inflammatory cream. Black pepper and turmeric have anti-inflammatory and analgesic properties due to piperine and curcumin present in them, respectively. Menthol has very well elaborated counterirritant properties that evoke a cooling effect, which helps relieve discomfort even more. The pH, viscosity, spreadability, and stability were few among many physicochemical characteristics evaluated for the cream after conventional processes in formulation. The active components, to ensure effectiveness and shelf life of the product, were combined with a suitable base and stability studies were performed under different conditions. Studies of analgesic and anti-inflammatory activity of the cream were carried out both in vivo and in vitro. In vivo studies used animal models that were subjected to experiments in pain and inflammation, while in vitro studies included anti-inflammatory assays such as suppression of protein denaturation and membrane stability. Creams at different percentage concentrations showed a significant pain and inflammation reduction compared to the control group; hence, strong analgesic and anti-inflammatory properties result. This research has, therefore, been conducted with a focus on using menthol, turmeric, and black pepper for the formulation of some very strong topical analgesic and anti-inflammatory creams. As observed, a formulation such as that can be an alternative to currently available conventional topical analgesic and anti-inflammatory drugs with safe, efficient, and natural attributes.

Key Words:- Black Pepper, Turmeric, Menthol, Analgesic, Anti-inflammatory.

1. INTRODUCTION: -

Herbal creams are topical formulations said to have therapeutic benefits, processing natural plant extracts, oils, and other botanical constituents. They are used to reduce the suffering from a number of dermatological diseases like dry skin, acne, psoriasis, and eczema. They are also valued due to their low potential for side effects and the safety profile perceived by individuals, making them one of the most wanted therapies by persons seeking natural remedies.[1] Tens of millions of people worldwide are suffering from chronic pain and inflammation, which decrease the quality of life and involve a very high expense on health resources. Although this is traditionally treated with pharmacological medications, concerns regarding their side effects and long-term safety has implored research in complementary therapies like herbal remedies. Turmeric, menthol, and black pepper are all naturally analgesic and anti-inflammatory products. These plants have been in use for millennia across different cultures for their traditional methods of reducing inflammation and discomfort. When combined in a topical cream formulation, these ingredients offer a very exciting approach to the management of inflammation and delivery of localized pain relief. [2]

Piperine is the bioactive compound of black pepper that modifies pain perception pathways and prevents the release of inflammatory mediators.

Curcumin is a potent anti-inflammatory agent of turmeric that acts by inhibiting the formation of inflammatory cytokines and enzymes, which finally become part of the inflammatory cascade. Menthol, produced from mint oils, produces a cooling sensation by triggering the cold-sensitive receptors in the skin, thereby relieving pain and misery. Black pepper, turmeric, and menthol are all complementary ingredients and excellent additions to a topical cream formulation for the purpose of providing both anti-inflammatory and dual action pain relief. Mixing these botanical ingredients in a cream base can deliver their bioactive compounds right at the site of action, thereby maximizing efficacy while reducing systemic side effects. [3] Although menthol, black pepper, and turmeric have long been reported as serving to control pain and inflammation, further studies are needed to verify both safety and efficacy in topical formulations.

This indeed underscores the need for clinical research on their pharmacological activities and therapeutic effects in cream preparations, so that practice can evidence base and decision making will be informed. In this light, this study has been carried out to research the extent of literature available with respect to the analgesic and anti-inflammatory properties of menthol, turmeric, and black pepper in relation to topical cream formulations. The study, therefore, will be conducted to justify the benefits and limitation associated with the incorporation of these natural ingredients into a synergistic cream for pain and inflammation alleviation by reviewing deeply clinical studies and scientific data about their potential benefits and limitations. [4]

2.AIM AND OBJECTIVES:-

2.1 AIM:-

The aim for the preparation of an analgesic and anti-inflammatory cream using black pepper (Piper nigrum) and turmeric (Curcuma longa) is to harness the natural therapeutic properties of these ingredients to create a safe, effective, and user-friendly topical formulation for pain and inflammation relief.

2.2 OBJECTIVE:-

1. Identify and incorporate appropriate concentrations of active compounds from black pepper (piperine) and turmeric (curcumin).

2.Ensure the selected ingredients have proven analgesic and anti-inflammatory properties.

3.Develop a stable cream base that ensures uniform distribution of active ingredients.

4.Conduct in vitro and in vivo studies to evaluate the pain-relief and anti-inflammatory effects of the cream.

3. PLAN OF WORK:-

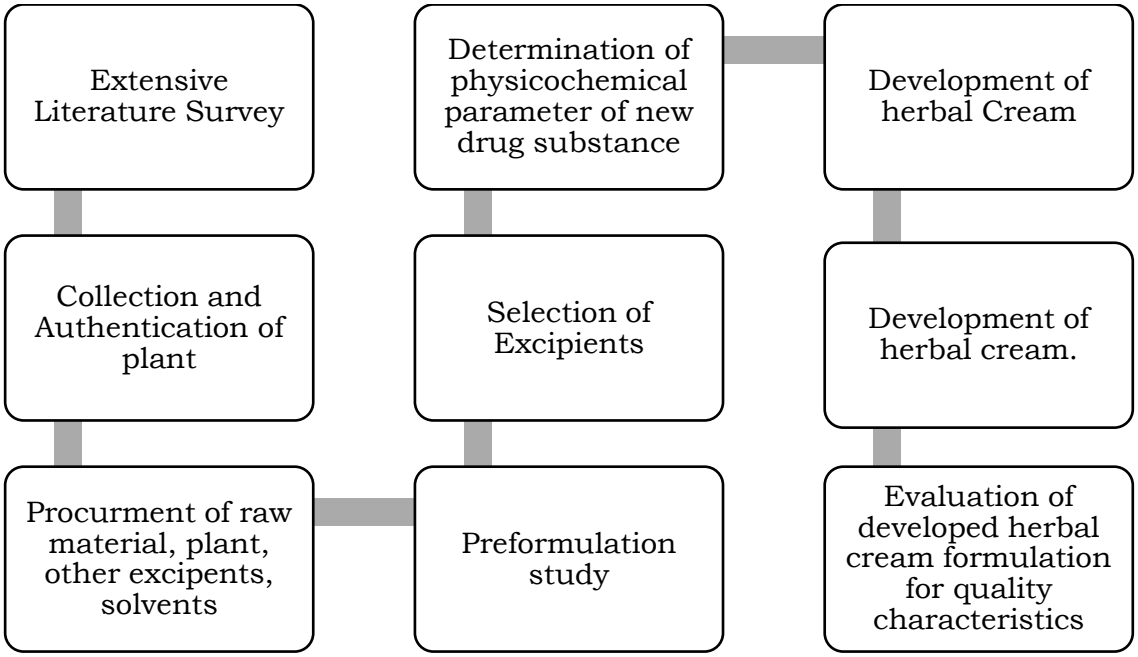

Figure No-1 Plan of work

4. PLANT PROFILE:-

4.1. Black Pepper:-

Figure 2:- Black Pepper (Piper nigrum L.).[5]

Botany Aspect:- **Table No-1** Classification of the pepper plant[6]

Sr. No.	Taxonomical classification	
1	Kingdom	Plantae
2	Subkingdom	Tracheophyta
3	Super-division	Spermatophyta
4	Division	Magnoliophyta
5	Class	Magnoliopsida
6	Subclass	Monocotyledonae
7	Genus	Piper
8	Order	Piperales
9	Family	Piperaceae (the Betel Tribe)
10	Species	*Piper nigrum* L.

Chemical Content:-

The chemical content in black pepper is saponins, flavonoids, essential oils, chavisin, resins, egg white, starch, piperine, piperylline, piperoleine, piperanine, dihydrocarveol, karyo fillene oxide, cariptone, tran piocarrol, and Pepper oil.[7]

Pharmacological Activities:-[9]

Antihypertensive activity
Anti-asthmatic activity
Cognitive action and Fertility activity
Antimicrobial activity
Antioxidant activity
Anti-cancer activity
Anti-inflammatory activity
Hepatoprotective activity
Anti-diarrheal activity
Digestive activity
Antidepressant activity
Immunomodulatory activity
Anticonvulsant activity
Analgesic activity
Effect of Piperine on metabolism

1. Analgesic Activity: Research has indicated that by modifying pain perception circuits, piperine may have analgesic effects. It could potentially lessen the experience of pain by interacting with nervous system receptors implicated in pain perception.

2. Anti-inflammatory Activity: It has been demonstrated that piperine has anti-inflammatory properties through the inhibition of pro-inflammatory enzymes and cytokines. Piperine may help reduce inflammation linked to a number of illnesses by inhibiting the synthesis of these inflammatory mediators.

Medicinal Uses Of Black Pepper :-[8]

Figure No-3 Medicinal Uses Of Black Pepper

4.2.Turmeric:-

Figure 4:-Turmaric(Curcuma Longa)[10]

Botany Aspect:-

Table No-2 Classification of the Turmaric plant

Sr. No.	Taxonomical classification	
1	Kingdom	Plantae
2	Subkingdom	Tracheobionia
3	Super-division	Spermatophyta
4	Division	Magnoliophyta

5	Class	Liliopsida
6	Subclass	Zingiberidae
7	Genus	Curcuma
8	Order	Zingiberales
9	Family	Zingiberaceae
10	Species	Curcuma Longa

Chemical Constituents: Curcumin, also known as diferrulolmethane, is the main ingredient and makes up 60% of Curcuma longa. It melts between 176 and 177 degrees Celsius and creates reddish-brown salts when combined with alkalis. Curcumin is insoluble in water but soluble in ethanol, alkalis, ketone, acetic acid, and chloroform. Curcumin's main chain is an aliphatic chain that is unsaturated and contains aryl groups that can or cannot be substituted. Rhizomes were steam-distilled to yield an essential oil (5.8%), which contained a-phelladrene (1%), sabinene (0.6%), cineol (1%), zingiberene (25%) and sesquiterpines (53%).[11,12] Yellow color is caused by curcumin (diferuloylmethane) (3–4%), which is made up of curcumin I (94%), curcumin II (6%) and curcumin III (0.3%). Curcumin's demethoxy and bis-demethoxy derivatives have also been identified.[13]

Pharmacological Properties:-

1	Analgesic Action	**7**	Turmeric in Urinary Disorders
2	Anti-inflammatory Action	**8**	Turmeric in Liver Diseases
3	Healing Property, Skin Care	**9**	Turmeric in Ophthalmic Care
4	Antidiabetic Property	**10**	Antitumor/ Anticancerous Activity
5	Anthelmintic Property Diseases	**11**	Anticholesterol Action
6	Turmeric in Respiratory Diseases		

Analgesic Action: The rhizome powder works well to relieve inflammation and sprains.[14]Applying a hot mixture of turmeric paste, lime juice, and saltpeter is a common remedy for sprains.[15]

Anti-Inflammatory Effect: Rheumatic symptoms are frequently linked to inflammatory changes in the joints. Turmeric is said to have anti-inflammatory and heat potency. It treats inflammation's pathological alterations and etiological causes.[16] Following two weeks of medication, a clinical trial involving eight patients with confirmed rheumatoid arthritis demonstrated a noteworthy reduction in morning stiffness and joint edema.[17]

Medicinal Uses Of Turmeric:- [18]

Figure No-5 Medicinal Uses Of Turmeric

4.3. Menthol:-

Figure No-6 Menthol(Mentha piperita) [19]

Botany Aspect:-

Table No-3 Classification of the Menthol plant[20]

Sr. No.	Taxonomical classification	
1	Kingdom	Plantae
2	Subkingdom	Tracheobionia
3	Super-division	Spermatophyta
4	Division	Magnoliophyta
5	Class	Magnoliopsida
6	Subclass	Asteridae
7	Genus	Mentha
8	Order	Lamiales
9	Family	Lamiaceae
10	Species	Mentha piperita

Chemical Constituent: The main constituent is menthol, which makes up 35–60%. Menthone, menthyl acetate, 1.8-cineole (eucalyptol), menthofuran, isomenthone, neomenthol, and limonene are the next most common constituents, at 2-44%, 0.7–23%, and 0.1–6%, respectively. The main sesquiterpene is β-caryophyllene, which makes up 1.6-2.8%.

7.3 Identification Test: - 7.3.1.Black Pepper:-[23]

Test	**Procedure**	**Observation**
1.Alkaloid	Mayers Test:- To 1 ml filtrate,few drop of mayers reagent are added by side of the test tube.	The white or creamy precipitate indicate test as positive.
2. Alkaloid	Hagers Test:- To 1 ml filtrate,few drop of Hagers reagent are added by side of the test tube.	A yellow precipitate was formed, indicating the presence of alkaloids.

Figure No-9 Identification Test of Black Pepper

7.3.2. Turmeric:-[24,25]

Table No -7 Identification Test of Turmeric

Test	**Procedure**	**Observation**
1.Curcumin Test	Add a few drops of concentrated hydrochloric acid (HCl) to an alcohol extract of turmeric.	Deep red color indicates curcumin
2.Lead Acetate Test	Add lead acetate solution to an aqueous extract of turmeric.	Yellow precipitate

Figure-10 Identification Test of Turmeric

7.4. Method of Preparation of Herbal Cream:-

Table No.8 List of chemicals.

No	**Ingredients**	**Quantity**	**Uses**
1	Black Pepper Oil	1 ml	Analgesic,Anti-inflammatary
2	Turmeric Extract	1ml	Analgesic,Anti-inflammatary
3	Menthol	0.05ml	Cooling Effect

4	Beeswax	12.5gm	Emulsifier
5	Lanolin	2gm	To treat or prevent minor skin irritations
6	Stearic Acid	2.5gm	emollient, emulsifier, and lubricant
7	Glycerin	6.25ml	Humectants
8	Triethanolamine	0.4ml	stabilize consistency, improves texture
9	Water	7.2ml	Solvent

1. Preparation of oil phase:-

12.5g beeswax, 2 g Lanolin, 2.5 g Stearic Acid and 1ml Black Pepper oil take in One Beaker melt at 70°c.

2. Preparation of aqueous phase:-

Take a beaker and add 0.2 ml Triethanolamine, 6.2ml Glycerin and Turmeric Extract and some sufficient water in that and heat the mixture at 70°c

3. Addition of aqueous phase to oil phase: - The aqueous phase added gradually to the oil phase at 70°c with continuous starring. Add Peppermint Oil on it. The prepared cream was transferred and allowed to cool. Add the preservative (methyl paraben) and Perfume (q.s) was added at last and the formulated cream was transferred to suitable container.

4. Packing :- Store in air -tight container.

5. Labeling: - It include name, ingredient, precautions, date of manufacturing, price and storage condition.

8. EVALUATION PARAMETERS OF CREAMS[26]

Table No-8 Evaluation Test Of Cream

Sr .No	Test	Procedure	Observation
1.	pH Determination	The pH of the cream can be measured on a standard digital pH meter at room temperature by taking adequate amount of the formulation diluted with a suitable solvent in a suitable beaker.	5
2.	Spreadability	Adequate amount of sample is taken between two glass slides and a weight of 100gm is applied on the slides for 5 minutes. Spreadability can be expressed as, S= m*l/t Where, m = weight applied to upper slide,l = length moved on the glass slide,t = time taken.	S=20x5.8/70 =1.65
3.	Physical appearance.	The physical appearance of the cream can be observed by its colour, roughness and graded.	Colour-Yellow. Odor-Distinct Aroma.
4.	Viscosity	Viscosity of formulated creams can be determined by using Brookfield Viscometer	Moderately Thick
5.	Homogeneity	The formulation was tested for the homogeneity by visual appearance and by touch.	Uniform, Consistent Texture and Smooth.
6.	Removal	The ease of removal of the creams applied was examined by washing the applied part with tap water.	Easily Removable.

7.	Type of smear	After application of cream, the type of film or smear formed on the skin were checked.	Smooth and Easy to Spread.
8.	Irritancy study	Mark an area of 1sq.cm on the left hand dorsal surface. The cream was applied to the specified area and time was noted. Irritancy, erythema, edema was checked, if any, for regular intervals up to 24hrs and reported.	Not Irritant.

9. RESULT AND DISCUSSION: -

The evaluation and formulation of the herbal cream might be showcased promising results in terms of pain relief effectiveness, anti-inflammatory properties, and sensory acceptability. This research provides a foundation for the development of a natural and efficacious skin care product, offering an alternative to conventional cream or ointment with potential broader applications in the field of body healthcare system after further studies.

1. Anti-Inflammatory Properties: Results may indicate a notable reduction, inflammation,suggesting the cream ability to address local inflammation.

2. Sensory Acceptance: Sensory evaluations revealed positive feedback on taste and

Smell, indicating the formulation's compatibility and consumer acceptability.

3. Analgesic Property: Testing result might be indicating a notable reduction in pain and its local effectiveness on body.

Sr .no	**Test**	**Observation**
1	pH Determination	5
2	Spreadability	1.65
3	Physical appearance.	Colour-Yellow Odor-Distinct Aroma
4	Viscosity	Moderately Thick
5	Homogeneity	Consistent Texture and Smooth.
6	Removal	Easily Removable.
7	Type of smear	Smooth and Easy to Spread
8	Irritancy study	Not Irritant.

Fig no 11. Formulation of cream.

10. Conclusion:-

The formulated analgesic and anti-inflammatory cream, enriched with black pepper, turmeric, and menthol, presents a promising natural alternative for pain and inflammation management. Its development could lead to a safer, more effective topical treatment option, reducing reliance on synthetic drugs

and their associated side effects. Future studies will focus on clinical trials to validate these results and explore the formulation's potential in broader therapeutic applications.

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