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FORMULATION AND EVALUATION OF ANTI-FUNGAL HAIR GEL CONTAINING KETOCONAZOLE

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Abstract:

Today, dandruff is a very serious issue; a number of treatments are offered on the market, but most only have short-term results. In an effort to create an anti-dandruff hair gel that is more effective for a longer period of time than existing commercial hair oils, carbopol 940 has been combined with the natural antifungal ketoconazole. Hair gel lengthens the duration that a drug is retained in the body and makes antifungal medications more effective. Aloe vera keeps your hair moisturised and guards against drying and damage. Ketoconazole's dosage is lowered by including aloe vera in the formulation, which also lessens the drug's negative effects.

Keywords: Anti-Dandruff hair gel, Ketoconazole, Stability study and in vitro study.

Introduction:

Any of the about 144000 different fungus species. This kingdom includes yeasts, mould, midews, rusts, smuts, and mushrooms. The term "fungal" sometimes refers to acquired organisms like slime moulds and oomycetes (water moulds), which are not members of the fungi kingdom. The domain Chromista includes a large number of different species, including fungus. The most common species on Earth are fungi. Some fungi can exist in both soil and water. Some organisms live as parasites or symbionts on plants or animals. Eukaryotic fungi have membrane-bound organelles and distinct nuclei in each of their cells. Fungi were originally thought to be a member of the Plantae kingdom, but they had to be separated from plants since they lack chlorophyll and have unique structural and physiological traits. Fungi are organisms that develop from the information contained in the filaments that make up their bodies. Before absorbing organic material, they digest it outside of their mycelia.

Fungi that are discovered in human hair are known as dandruff. Its medical name is pityriasis simplex capitis. Either it will be dry or greasy. While greasy falkas are pale yellowish and have a terrible scent, dry dandruff is silvery and white in appearance. People of all ages are susceptible to the fairly common, non-contagious hair condition known as dandruff. It is a widespread, degrading disorder that affects nearly 5% of people worldwide. There are many antifungal drugs that can be used to treat dandruff. For the treatment of dandruff, it is now possible to use zinc pyrithione, 2-hydroxybenzoic acid, imidazole derivatives, acid, steroids, sulphur, and tar derivatives. Numerous anti-fungal chemicals are widely utilised in hair shampoos for the treatment of dandruff.

Composition of Dandruff - The dandruff scale is made up of corneocyte clusters. It is highly cohesive with one another and naturally separates from the broad surface of the horny layer. Dandruff is typically brought on by parakeratotic cells. Scale size and density vary widely from one location to another.

Common site of dandruff distribution:

- Hairy areas of the head
- bearded areas of the body
- brows and eyelashes
- the forehead
- external ear canals
- and post-auricular folds

Sign and symptoms of Dandruff:

- On the person's scalp and in their hair, there are white skin flakes.
- Flakes could seem greasy.
- You can get stiffness and itching in your head.
- Headaches with tingling sensations.
- You might be experiencing headache pain.
- Patches of red, scaly, oily skin.

Materials And Method

Materials

Equipment

a small volume Brookfield viscometer, a magnetic stirrer, a digital Ph metre, a spread ability equipment, and ultraviolet (UV) [LABINDIA ANALYTICAL(UV3092)], Analytical balance and multipurpose ultrasonic cleaning (Athena technology; ISO 9001:2015).

Method

Preparation of calibration curve of ketoconazole:

At various standard dilutions of 2, 4, 6, 8, and 10g/ml of drug in methanol, the absorbance of each solution was measured at 226 nm against a methanol blank. A common graph was produced by plotting the concentration vs the absorbance values.

Preparation of gel containing ketoconazole:

1] Methyl parabens, glycerin, and polyethylene glycol were measured amounts and were dissolved in roughly 35 ml of water in a beaker while being swirled rapidly with a mechanical stirrer.

2]Then, while stirring, Carbopol 940 was gradually added to the beaker containing the aforementioned liquid.

3] Ketoconazole medication was dissolved in ethanol and added to the previously mentioned solution while stirring. The solution was then neutralised by gradually adding triethanolamine solution while being constantly stirred till the gel was produced.

Formulation table:

Ingredients	F1	F2	F3	F4	F5	F6
Ketoconazole(gm)	0.1	0.1	0.1	0.1	0.1	0.1
Carbopol 940(gm)	0.1	0.2	0.3	0.4	0.5	0.6
Polyethylene Glycol 400(gm)	4	4	4	4	4	4
Sodium benzoate (gm)	0.1	0.1	0.1	0.1	0.1	0.1
Triethanolamine (ml)	0.3	0.3	0.3	0.3	0.3	0.3
Propylene glycol (ml)	3	3	3	3	3	3
Distilled water (ml) (Q.S)	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S

1] Psycho rheological characteristic:

The Psycho rheological Characteristic (colour, clogging, homogeneity, and texture) was examined for hair gel formulations.

2] Washability:

After the formulas were applied to the skin, they were personally tested to see how simple and thorough water cleansing was.

3] Extrudability Study:

Compositions for hair gel were put in aluminium or metal collapsible tubes. Testing the formulation's extrudability involved extruding the material through the tubes.

4] Spreadability:

Each formula's 0.5 g sample was compressed between two slides and left for 5 minutes with no hope of additional spreading. In order to compare the spreadability of the circles, their centimeter-scale diameters were employed. Three separate determinations were averaged to provide the acquired values.

Spreadability = $\frac{m.l}{t}$

Where, S=Spreadability (gcm/sec)

m=weight tied to the upper slide(20grams)

l=length of glass slide(6cms)

t=time taken is seconds.

5] Determination of pH:

The pH of hair products was determined using a digital pH metre. The electrode was immersed in the gel formulation for 30 minutes until a consistent reading was obtained. One gramme of gel was dissolved in 25ml of distilled water. Additionally, a lot of reading was being done. Each formulation's pH values were verified twice.

6] Viscosity:

To gauge the gel's viscosity, a Brookfield digital viscometer was employed. Spindle no. 6 was used to measure the viscosity at 10 rpm and 25°C.The right amount of gel was dispensed into a container with a wide opening. The gel was positioned in the wide mouth container such that the spindle of the viscometer could be dipped inside of it. The gel samples were allowed to rest for 30 minutes at a constant temperature (25 + 1°C) before the measurements.

7] Drug content:

By diluting 1 gramme of gel in a 10 ml volumetric flask and detecting the result at 226 nm2 with a UV-Visible Spectrophotometer, the drug concentration was determined.

8] In vitro drug release study:

In a test tube, ketoconazole was extracted from hair gel using the dialysis procedure. The donor medium phosphate buffer (pH 7.4) was gathered and placed in a 250 mL beaker. The hair gel solution was kept in the test tube with egg membrane and the donor medium was then put on a magnetic stirrer and stirred at 50 rpm at 37o 0.5oc. A sample of 5 ml was then taken from the donor medium every 5 minutes to maintain the sink condition. The samples were then analysed using phosphate buffer, pH 7.4, as a blank and UV visible spectroscopy at 226 nm.

9]Anti-fungal Activity:

Antifungal drug efficacy could be demonstrated therapeutically by inhibiting fungal growth under controlled conditions. The cup-plate method, which depends to some extent on the drug diffusing from the gel in which it

is enclosed through a layer of firm agar in the petri dish, was used to evaluate the gels microbiologically. This method results in increased growth. Microorganisms are entirely removed all the way around the cup in a zone.

An better drug release from the body base is indicated by a bigger inhibition zone, which is a favourable thing.

Medium used: Sabouraud dextrose broth

Test organism: Candida albicans species

Due to the medium's low pH and high sugar content, in addition to being antibacterial and antifungal, this is also very fungi-selective.

Sr. No	Content	Quantity
1.	Glucose	40gm
2.	Peptone	10gm
3.	Agar	20gm
4.	Water	1liter

Table no.1. Composition of Sabouraud Dextrose Broth Medium

The ingredients should be heated until they are dissolved, filtered through cotton gauze, then autoclaved for two hours at 1210 C with the pH adjusted to 5.4.

Test procedure:

To ascertain the biological activity of a hair gel formulation created against fungus, antifungal experiments were carried out. The Sabouraud dextrose diffusion test, which employed the "cup plate approach" and previously sanitised petri dishes, was used to evaluate this. The test organism (Candida albicans) was previously seeded into the wells of a sabouraud dextrose plate using a solution of gel-prepared formulation and pure ketoconazole at a concentration of 1 mg/ml. After allowing the fluid to diffuse for two hours, the plates were incubated at 270 for 48 hours. Each cup's zone of inhibition was measured and compared to the norm.

RESULT AND DISCUSSION:

Evaluation of gel formulation

1] Psychorheological characteristic:

All formulations, with the exception of F5 and F6, show favourable psychorheological characteristics. Two psychorheological characteristics are impacted by carbopol levels more than 4.5gm: clogging and homogeneity.

Form	Colour	Clogging	Homogeneity	Texture
HG1	Turbid	Absent	++	Smooth
HG2	Off white	Absent	++	Smooth
HG3	white	Absent	++	Smooth
HG4	Off white	Absent	++	Smooth

HG5	Off white	Present	+	Smooth
HG6	White	Present	+	Smooth

Table no.2: Psychorheological Characteristics

2]Washability:

All of the formulations were washable, with the exception of F5 and F6.

Formulation	**Washability**
F1	++
F2	++
F3	++
F4	++
F5	+
F6	+

Table no.3: Washability

3]Extrudability:

All formulations had good to satisfactory extrudability. Ejecting the gel from the tube during application and to ensure patient compliance is essential. Gel formulations with low concentrations of the gelling agent were found to have acceptable extrudability, and gel formulations with high concentrations of the gelling agent were found to have satisfactory extrudability.

Formulation	**Extrudability**
F1	90.65
F2	85.21
F3	80.14
F4	68.50
F5	75.62
F6	70.86

Table no.4: Extrudability

4] Spreadability:

Spreadability is essential for patient adherence and makes it easier to apply gel to the skin consistently. A excellent gel has a wide spreadability range and spreads swiftly. The spreadability of the generated gel decreased as the concentration of the gelling component increased.

Formulation	**Spreadability(gm/sec)**
F1	9.3

F2	8.5
F3	7.2
F4	7
F5	6.8
F6	6

Table no.5: Spreadability

5] Determination of pH:

All gel formulations were found to have a pH between 6.9 and 7.5, which is within the usual pH range of skin.

Formulation	**pH**
F1	6.9
F2	7.1
F3	7
F4	7.1
F5	7.3
F6	7.2

Table no.6: Determination of pH

6] Viscosity:

Due to its impact on the spreadability, extrudability, and medicine release, viscosity is a critical factor to consider when discussing gels. All of the generated gels demonstrated increasing viscosity as the gelling agent's concentration was increased.

Formulation	**Viscosity(cps)**
F1	3256
F2	3470
F3	3864
F4	4255
F5	4786
F6	5126

Table no.7: Viscosity

7]Drug content:

All of the created gel formulations contained the same amount of medicine and were within allowable bounds, showing uniform drug dispersion across the gels.

Formulation	**Drug content**
F1	93.78%
F2	96.34%
F3	96.02%
F4	96.56%

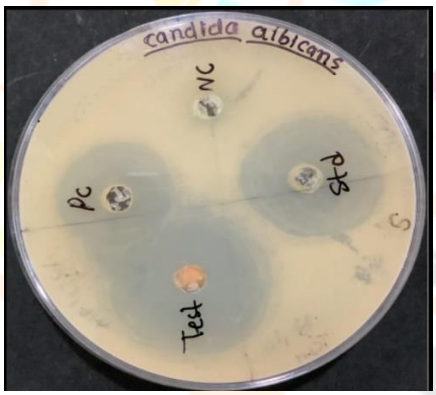
F5	96.14%
F6	95.57%

Table no. 8: Drug content

8]Anti-fungal Activity:

When it came to release and the largest zone of inhibition, F4 performed better than the other formulations. F4 was picked as the best Hair gel formulation as a consequence.

Sample number	**Zone of inhibition**
Negative control	No zone
Positive control	25mm
Standard	26mm
Test	30mm



Conclusion:

In vitro drug release, viscosity, spreadability, washability, anti-fungal effectiveness, and drug content of ketoconazole hair gel were all examined. F4 outperformed other formulas in comparison. As a result, the objective of developing and testing ketoconazole hair gel was accomplished.

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