

FORMULATION AND EVALUATION OF HERBAL HAIR DYE POWDER FOR GREY HAIR COVERAGE AS A SAFE ALTERNATIVE TO SYNTHETIC HAIR DYES

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Abstract :

Background :

Hair colouring is something that a lot of people do to look good and to cover up grey hair. The hair dyes you can buy in stores have a lot of chemicals in them like para-phenylenediamine, ammonia, hydrogen peroxide and resorcinol. These dyes work well and the colour lasts a long time but using them a lot can cause problems like irritated scalps, allergic reactions and damaged hair. Some people even think they can be bad for your health in the run. Because of this people are looking for more natural ways to colour their hair.

Using herbs to dye hair is becoming really popular because it is safe and good for the environment. Herbs can also make your hair healthier. This study is about making hair dye from things like Jamun seeds and Kalonji. Jamun seeds have things in them that give them a colour and Kalonji seeds have things that help the colour stay and make your scalp healthier.

We made two kinds of hair dye. The first one used Jamun seeds and some other natural things to help the colour stick. It took a day for the colour to really take hold. The second one used Kalonji. Was meant to work faster in just a few hours. We also used some herbs like henna, indigo and aloe vera to help make the dye work better and make your hair and scalp healthier.

We tested the hair dyes to see how they looked how they smelled and if they would irritate your skin. The results were good. The colour looked nice it did not irritate the skin. It made your hair feel soft. This study shows that using Jamun and Kalonji to dye hair is an idea because it is safe works well and is good, for the environment.

Objective :

The main goal of this study is to make a hair dye powder using natural ingredients like Jamun and Kalonji seeds to provide safe and effective hair coloring. The study also wants to improve hair health. It aims to avoid the effects of chemical-based hair dyes. These natural ingredients can make hair coloring safe and effective. The study focuses on hair health and safe coloring. It looks for alternatives, to chemical-based dyes. Herbal hair dye powder is the objective.

Methods :

Jamun seeds and Kalonji seeds are cleaned up first. This is done to get rid of any stuff in them. After that they are dried in the sun. This helps to remove all the moisture from the Jamun seeds and Kalonji seeds.

The Jamun seeds and Kalonji seeds are then made into powder. They are ground up separately. Then sieved. This is done so that the powder is the size all over.

The powder from the Jamun seeds and the powder from the Kalonji seeds are then mixed, with some herbal stuff. This is only done if other herbs are being used. The powders are mixed well so that everything is combined properly.

Finally the herbal hair dye powder that has been made from the Jamun seeds and Kalonji seeds is put in a container. This container is airtight. It helps to keep the hair dye powder dry and fresh..

Results :

The formulated herbal hair dye powder containing Jamun based herbal hair dye powder and Kalonji based herbal hair dye powder was smooth, fine, and easy to handle, with a natural color and pleasant smell. It showed good coloring ability by giving a brownish shade to the hair and had a suitable pH, making it safe for scalp use. No irritation was observed during application, and the formulation remained stable without any noticeable changes during storage and passed the evaluation tests indicating its safety and effectiveness.

Key Words : Key herbal ingredients, Formulation, Evaluation, Discussion.

Introduction :

Hair has an impact on how we feel about ourselves and how we look. When our hair starts to turn grey because we are getting older or for reasons we often think about using hair dye. The problem with hair dye is that it can hurt our hair and cause problems on our scalp. This is because it has a lot of stuff in it that can damage our hair over time.^[1,2]

On the hand using things like plants and seeds to colour our hair is a lot safer. This is because they work in a way and do not mess with the inside of our hair. ^[3]For example Jamun seeds have a lot of colour in them that can make our hair look darker. Kalonji seeds are also very good because they have things in them that help our scalp and make our hair look better.

We can use these seeds to make a hair dye that's gentle and good for our hair. This way we can colour our hair. Also take care of it at the same time. Hair dye made from plants, like Jamun seeds and Kalonji seeds is a way to keep our hair looking good and feeling healthy.^[4,5]

Jamun (*Syzygium cumini*):

Jamun seeds contain natural pigments that help provide dark colour to the hair and also protect it from damage due to their antioxidant properties and are rich in anthocyanins, flavonoids and polyphenolic contents . They offer a natural and gentle way to colour hair with minimal side effects.^[6]

Kalonji (*Nigella sativa*):

Kalonji seeds help nourish the scalp, strengthen hair, and reduce hair fall and also contains thymoquinone, alkaloids, and essential fatty oils. In herbal hair dye, they support better colour absorption and improve the overall effectiveness of the formulation.^[7]

Materials and Methods :

Materials Used:

The substances utilized in this study were derived from herbal sources and were of pharmaceutical quality when relevant. All herbal components were sourced from a local vendor.

Materials List:

- Seeds of Jamun (*Syzygium cumini*)
- Kalonji seeds (*Nigella sativa*)
- Henna powder (*Lawsonia inermis*)
- Indigo pigment (*Indigofera tinctoria*)
- Amla powder (*Emblica officinalis*)
- Fenugreek seeds (*Trigonella foenum-graecum*)
- Aloe vera gel
- Powder from pomegranate peels
- Alum (*Potassium alum*)
- Citrus juice / Cider vinegar
- Purified water

Formulation of Jamun Seed–Based Herbal Hair Dye Powder:

Jamun (*Syzygium cumini*):

Jamun is a tropical evergreen tree belonging to the family Myrtaceae. The seeds of Jamun are rich in anthocyanins, flavonoids, tannins, and polyphenolic compounds. These constituents impart natural dark pigmentation and exhibit antioxidant and antimicrobial properties. Jamun seeds have traditionally been used in herbal medicine and cosmetic preparations.



FORMULATION STEPS :

Step 1: Making Powder from Jamun Seeds

The seeds of Jamun were cleanly rinsed with distilled water to eliminate any impurities. The cleaned seeds were shaded to dry and then dried at a low temperature to eliminate all moisture. The dried seeds were subsequently ground into a fine powder with a mechanical grinder and sifted to eliminate larger particles.

Step 2: Making Jamun Seed Decoction

Approximately 20 g of Jamun seed powder was mixed with 200 mL of distilled water and heated at 70–80°C for 30–40 minutes while stirring continuously. The blend was permitted to cool and was filtered with muslin cloth to acquire a dark-colored extract.

Step 3: Incorporation of Mordant

Alum (1 g) was dissolved in warm distilled water and gradually mixed into the filtered Jamun extract while stirring continuously.

This action was taken to improve the binding of pigment to hair keratin.

Step 4: Addition of Complementary Herbal Components

Henna powder, indigo powder, amla powder, and fenugreek powder were slowly incorporated into the extract and thoroughly blended to achieve a uniform paste.

Step 5: Adjusting pH

The pH of the mixture was assessed with pH paper and modified to 5.0–5.5 with lemon juice or apple cider vinegar.

Step 6: Aging of Dye Paste

The prepared paste was sealed and left to sit for 6–8 hours at room temperature to facilitate pigment activation and oxidation.

Formulation of Kalonji-Based Herbal Hair Dye Powder:

Kalonji (*Nigella sativa*)

Kalonji is a flowering plant that grows annually and is part of the Ranunculaceae family. The seeds have bioactive substances like thymoquinone, alkaloids, and essential fatty acids.

Kalonji is commonly utilized in traditional medicine to enhance hair growth, nourish the scalp, and prevent hair loss



Kalonji seeds

FORMULATION STEPS:

Step 1: Preparing Kalonji Extract

Kalonji seeds (50 g) were gently toasted over a low heat for 3–5 minutes. The seeds were roasted, ground into powder, and then boiled in 250 mL of distilled water for half an hour. The decoction was concentrated to half, allowed to cool, and then filtered.

Step 2: Creating Natural Mordant

Black tea leaves were steeped in distilled water for 10 minutes to create a decoction rich in tannins, which was then filtered and allowed to cool.

Step 3: Making Herbal Dye Paste

The extract of Kalonji was combined with henna powder, indigo powder, amla powder, fenugreek gel, aloe vera gel, and a decoction of black tea. Several drops of castor oil were included to enhance absorption and nourishment.

Step 4: pH Adjustment

The formulation's pH was modified to 5.0–5.8 by utilizing lemon peel extract or aloe vera gel.

Step 5: Break Time

The mixture was permitted to sit for 30–45 minutes to activate the pigments.

Role of Common Supporting Herbal Ingredients :

- Henna: Acts as a natural binder and provides keratin adhesion
- Indigo: Enhances dark shade formation
- Amla: Maintains acidic pH and stabilizes colour
- Fenugreek: Improves conditioning and penetration
- Aloe vera: Provides hydration and scalp protection



Amla



Henna



Indigo powder



Fenugreek seeds



Aloe vera gel

Method of Application :

The necessary quantity of herbal hair dye powder is placed in a bowl and combined with water to create a smooth, lump-free mixture.

The mixture is subsequently spread uniformly on clean, dry hair from roots to tips with a brush or gloves. It remains on the hair for approximately 30–60 minutes to ensure adequate coloring, and is then washed out completely with regular water. Once dried, the hair acquires a natural hue while enhancing its softness and luster

Storage Conditions :

The herbal hair dye powder must be kept in a clean, dry, and sealed container to shield it from dampness and impurities. It should be stored in a cool area shielded from direct sunlight and heat to preserve its color and efficacy. Correct storage aids in maintaining its stability and guarantees that the formulation stays safe and appropriate for use for an extended duration

FORMULATION TABLE OF HERBAL DYE POWDERS:

Ingredients	F1 (KALONJI SEED POWDER)	F2 (POMEGRANATE PEEL POWDER)	F3 (BEETROOT EXTRACT OR POWDER)	F4 (SOAKED ALMOND)	F5 (JAMUN SEED POWDER)
Kalonji seed powder	25g	–	–	–	–
Dried Pomegranate peel powder	–	35g	–	–	2g
Beetroot extract or powder	–	–	25g	–	–
Soaked Almond	–	–	–	10-15pcs	–
Jamun seed powder	–	–	–	–	25g
Henna powder	5g	–	–	4g	7g
Amla powder	8g	1g	10g	3g	7g
Hibiscus powder	–	–	9g	–	–
Coffee decoction	Q.S	Q.S	Q.S	15ml	Q.S
Indigo powder	3g	–	–	4g	2g
Aloe vera gel	5g	–	5g	4g	3g
Fenugreek seeds	–	–	–	5g	–
Lemon juice	2ml	3ml	3ml	2ml	2ml
Alum powder	3g	5g	0.5g	3g	3g
Salt	1g	4g	1g	2g	1g
corn flour	–	5g	–	–	–
Coconut oil	–	5ml	3ml	2ml	–
Iron nails	–	–	3(nails)	–	–
Iron Water	–	–	10ml	–	–
Total(gm)	50g	50g	50g	25g	50g

Discussion:

Five distinct formulations of herbal hair dye powders (F1–F5) were created with different plant ingredients to evaluate their coloring efficacy, stability, and conditioning benefits.

F1 (Kalonji) and F5 (Jamun) displayed superior colouring results because of the strong natural pigments they contain, combined with henna and indigo, enhancing both colour richness and hair condition.

F2 (Pomegranate) and F3 (Beetroot) offered mild to moderate coloring, but their influence was constrained by reduced pigment potency and durability.

F4 (Almond) exhibited minimal coloring effect as it primarily functioned as a conditioning and nourishing agent instead of a dye. In general, the formulations based on Jamun and Kalonji showed superior effectiveness, stability, and appropriateness as natural hair dye powders.

EVALUATION PARAMETERS**

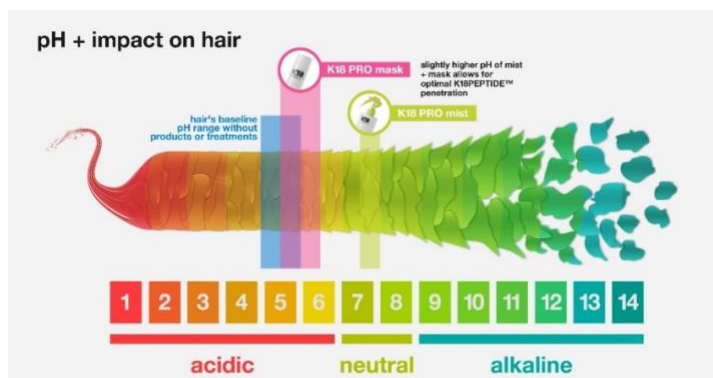
The herbal hair dye powders that were prepared were assessed to determine their quality, safety, and effectiveness.

Sensory Assessment:

Organoleptic characteristics like color, odor, and texture were noted to guarantee an appealing appearance and acceptability.

Establishment of pH:

The pH was assessed to ensure compatibility with the scalp and to prevent irritation.



Color Staining Effectiveness:

The capability to stain and cover grey hair was assessed using hair strands to determine the efficacy of the dye in delivering color.

Grey hair coverage test:

Gray hair strands were uniformly covered with the dye paste and left for the required time. The strands were washed and dried prior to assessment.

Performance Conditioning:

Conditioning performance assesses the sleekness, gentleness, and controllability of hair post-dye application.

Prick Test for Skin Irritation:

This assessment examines the safety of the formulation for external use.

Wash Resistance Research:

Colored hair strands underwent multiple washings with water. Colour durability was noted following every wash.

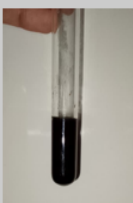
Stability Investigations:

The formulations were kept at room temperature and monitored for alterations in colour, pH, and texture over time.

PHYTOCHEMICAL EVALUATION TEST:

Phytochemical Tests Passed by Jamun Seed Powder and Kalonji Seed Powder (Herbal Hair Dye)

The following qualitative phytochemical screening tests show positive results:

TEST	OBSERVATION	RESULT	IMPORTANCE	
1. Test for Tannins (Ferric Chloride Test)	Blue-black / greenish black color	Positive	Tannins act as natural mordants and help in color fixation on hair.	
2. Test for Flavonoids (Shinoda Test)	Pink / dark red color formation	Positive	Provide natural pigment and antioxidant activity.	
3. Test for Phenolic Compounds (FeCl ₃)	Deep blue or violet color with FeCl ₃	Positive	Responsible for dark color development and stability.	
4. Test for Alkaloids (Dragendorff's / Mayer's Test) – mainly Kalonji	Dark brown colour	Positive	Strengthens hair follicles and promotes scalp health.	
5. Test for Saponins (Foam Test)	Stable persistent foam	Positive	Natural cleansing and penetration enhancer.	
6. Test for Glycosides (Keller–Killiani Test)	Reddish-brown ring	Positive	Contributes to hair nourishment and color retention.	

RESULTS AND DISCUSSION**

The herbal hair dye powder that was prepared was fine, consistent, and dark in hue, emitting a pleasant herbal fragrance, indicating effective mixing of the components. The pH was determined to be similar to that of the natural scalp, suggesting that the formulation is mild and safe for application.^[8,9]

Phytochemical analyses verified the existence of natural pigments and advantageous substances, primarily derived from Jamun and Kalonji seeds, which contribute to efficient dyeing.^[10,11] When used on grey hair, the formula resulted in a distinct dark brown to black color with decent color retention even post-wash. Furthermore, the hair that was treated felt more manageable, silkier, and in better condition, indicating that the formula not only delivered color but also enhanced hair texture and nourishment.^[12]

Discussion :

The herbal dyes showed effective colouring capability due to the interaction between natural polyphenols and hair keratin. Tannins served as natural mordants that enhanced pigment attachment. In contrast to synthetic dyes that aggressively change the cortex, these formulations applied color softly, minimizing structural harm.^[13,14]

Jamun offered deep coloration because of its anthocyanin levels, whereas Kalonji enhanced conditioning with its oil components.^[15] The blend of coloring and healing properties makes herbal dyes beneficial for extended use.

While the development of colors was not as rapid as that of chemical dyes, enhanced safety, environmental friendliness, and nourishment for the scalp make up for this drawback.^[16] Therefore, herbal dyes serve as a practical alternative to traditional synthetic options.

Conclusion :

Herbal hair dye powders made from Jamun and Kalonji were effectively developed and assessed.

The formulas demonstrated successful color application, compatibility with the scalp, conditioning advantages, and negligible irritation. These results demonstrate that dyes sourced from plants can offer safe and environmentally friendly options for coloring hair cosmetically. Additional improvement could enhance shade variety and durability.

This study effectively created a herbal hair dye powder utilizing Jamun and Kalonji seeds combined with various natural components. The formulation demonstrated effective coloring capabilities, particularly on grey hair, and resulted in a natural dark hue. It was determined to be safe for application, as its pH level was appropriate for the scalp and no irritation was noted. Besides adding color, the formulation also enhanced hair softness and overall look. The findings suggest that this herbal hair dye may serve as a safer and effective substitute for chemical dyes, offering additional hair care advantages.

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