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Formulation and Evaluation of "TRESSPAN"- A Nutraceutical Capsule for Reducing Hair fall

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ABSTACT :

Hair fall (alopecia) is, kind of a very common cosmetic & health problem, worldwide in both men & women, you know. It can show up because of nutritional deficiencies, hormonal imbalance, mental stress, genetic predisposition, scalp infections, environmental pollution, aging, and also unhealthy lifestyle habits. People have started to pay more attention to using herbal ingredients for nutritional supplementation, mostly because they're considered safer, have decent nutritional value, and tend to cause less incidence of side effects when compared to synthetic drugs.

The present study was conducted with the aim to craft a polyherbal nutraceutical capsule, containing Amla powder, Pumpkin seed powder, Date powder, Chia seed powder, Flaxseed powder, Onion extract, Almond powder, Sesame seed powder, Corn powder and Rosemary extract. These components were selected due to their nutritional merit, plus their traditional use in supporting healthy hair growth, over time. The formulation itself was made rather straightforwardly, by blending the powders first and then encapsulating them into hard gelatin capsules, without much complexity.

The prepared capsule is expected to provide antioxidants, proteins, good fatty acids, vitamins, minerals, and phytochemicals, which may help in strengthening the hair follicles, feeding the scalp, lowering oxidative stress, supporting better blood circulation, and minimizing excessive hair fall. Overall, this formulation is planned to function as a safe, inexpensive, natural dietary supplement, aimed at long-term nutritional support.

Keywords: Hair fall, Nutraceutical capsule, Herbal formulation, Amla, Pumpkin seed, Polyherbal supplement, Hair growth.

INTRODUCTION

Hair is like a big indicator of beauty, youthfulness, and general health. The human scalp has around 100,000 hair follicles, and they kinda keep moving in a cycle of anagen (growth), catagen (transition) and telogen (resting) phases. When that cycle gets interrupted for real, hair can start falling out in large amounts.

Lately, modern life has made hair fall a super common issue. Poor eating habits, too much stress, not enough sleep, hormonal imbalance, environmental pollution, smoking, and even nutritional deficiencies are usually the main causes that end up weakening the hair follicles over time.

To keep hair healthy, you need certain nutrients such as proteins, essential fatty acids, vitamins, minerals, and antioxidants. If your body doesn't get enough of them then your hair may become thinner, feel weaker, and it can also grow slower than expected.

In many cases, the most prescribed synthetic medications for hair loss include Minoxidil and Finasteride, but they can come with side effects like scalp irritation, itching, dizziness, hormonal disturbances, and the fact that treatment often needs to continue for a long period.

Because of that, herbal nutraceuticals are now being seen as a safer alternative. Polyherbal formulations actually combine the therapeutic potential of multiple medicinal plants along with nutrient rich foods, so you get a sort of synergistic effect that supports hair health while keeping the adverse reactions minimal.

So, this study was planned to formulate a nutraceutical capsule using selected herbal ingredients that can provide the nutritional backing needed for maintaining healthy hair, in a consistent way.

NEED OF THE STUDY

Most times people are prescribed synthetic meds for hair loss like Minoxidil and Finasteride, but these can come with annoying side-effects such as scalp irritation, itching dizziness, hormonal disturbances, and also the need to stay on treatment for a long time.

Because of that, herbal nutraceuticals are now being seen as a safer alternative, kind of a more tolerable option in daily use. Polyherbal formulations are basically combinations of the therapeutic potential from a few medicinal plants and nutrient rich foods. In this way they can work with a synergistic effect to help hair wellbeing while keeping the adverse reactions fairly minimal.

In the present study, the goal was to formulate a nutraceutical capsule using selected herbal ingredients, which can supply the nutritional support needed

to maintain healthy hair.

AIM & OBJECTIVES

AIM:

So, you would try to formulate a polyherbal nutraceutical capsule with natural herbal ingredients, in order to reduce hair fall and generally improve overall hair health. Like, sort of, it's meant to help.

OBJECTIVES:

- Develop a nutraceutical capsule, using natural herbal ingredients in a sort of overall balanced way.
- Provide nutrition directly to the hair follicles, so they can work better, more steadily.
- Help scalp health by using ingredients that are rich in antioxidants, which is kind of important.
- Deliver proteins, healthy fats, vitamins and minerals that are needed, for the body to stay supported.
- Create a stable and uniform capsule, that doesn't act weird during handling or storage.
- Check the physical quality of the prepared capsules, meaning size, texture, and so on.
- Encourage healthy hair growth in a natural manner, not forcing anything too much.

INGREDIENTS & THEIR FUNCTIONS

INGREDIENT	ROLE
Amla powder	Source of vitamin C
Pumpkin seed powder	Sulphur compound
Dates powder	Iron & vitamin B5
Chia seed powder	Omega-3 & fibre source
Flaxseed powder	Omega-3 & lignans
Onion Extracts	Sulphur and flavonoids
Cashew powder	Used as a source of zinc
Almond Powder	Used as a source of Biotin and vitamin E
Rosemary powder	Preservatives
Corn flour	Filler

PLANT PROFILE

1. AMLA
Family: Phyllanthaceae,
Part used: Fruit
Main Constituents: Vitamin C, Polyphenols, Tannins, and Gallic acid, all in the mix.

Uses:
It works like a strong antioxidant, helps stimulate collagen production, and this can support strengthening the roots of hair, so it feels more stable.
Also, it may help stop or slow down premature greying, over time.

2. PUMPKIN SEED
Family: Cucurbitaceae.
Part used: seeds
Main constituents: Zinc, Magnesium, Healthy fat, Proteins

Uses
kind of nourishes the hair follicle and, somehow supports growth
Helps promote a healthy scalp, without the usual dry feeling

Also, a good minerals source, for everyday balance

3.DATES

Family: Arecaceae
Part Used: Fruits,
Main Constituents: Iron, Potassium, natural sugar, fiber in the diet

Uses:
Helps with blood circulation, in a kind of quiet way.
Works as an energy source for daily life.
Gives vital minerals too, which is kinda important.

4.CHIA SEED

Family: Lamiaceae
Part used: seed

Main constituents: Omega-3 fatty acids, protein, calcium, fiber

Uses:
Helps improve scalp hydration
Supports hair strength in a quieter way
Rich antioxidant, source of goodness also

5.FLAXSEED

Family: Linaceae
Part Used: Seed

Main constituents: Omega 3 fatty acids, Lignans, Fiber, Protein

Uses:
Helps reduce inflammation, overall
Improves hair elasticity
Nourishes hair follicles, in a steady way

6.ONION

Family: Amaryllidaceae
Part used: bulb Extract
Main constituents: sulphur compounds, flavonoids, quercetin

Uses:
Supports keratin production
Improves scalp circulation, somehow
Strengthens hair roots.

7.ALMOND

Family: Rosaceae
Part used: Seed

Main constituents: Vitamin E, protein, healthy fats, and magnesium.

Uses:
It helps to nourish hair,
Keeps dryness away,
Generally, supports healthy hair growth.

8.CASHEW

Family: Anacardiaceae
Part used: Seed
Main constituents: protein, healthy fats, zinc & magnesium

Uses:
Supports hair and scalp nutrition, in a kind of steady way
Helps deliver essential minerals, for normal hair health
Supports healthy hair structure, and it can make things more resilient too
Provides antioxidant and nutritional support that can help overall balance, too much I guess

9.ROSEMARY

Family: Lamiaceae,
Part used: leaf extract,
Main constituents: rosmarinic acid, carnosic acid & essential oils.

Uses:
Natural preservative.
Antioxidant support.
Helps with scalp health.

10.CORN FLOUR

Family: Poaceae
Part Used: Endosperm / Seed
Main constituents: Carbohydrates mostly starch, Protein, Dietary fibre

Uses:
It kind of works as a filler, and also as a carrier, when people make capsule formulations , so the mix holds together better.
It gives bulk, which makes the whole mixture feel more substantial too, not so thin and airy.
It also helps with powder flow, so capsule filling becomes easier, and in general smoother.
On top of that, it adds a bit more nutritional value , beyond what is already there, which is nice i guess.

FORMULATION TABLE

INGREDINENTS	QUANTITY / CAPSULE (mg)	QUANTITY FOR 60 CAPSULES (gm)
Amla Powder	90 mg	5.8 g
Pumpkin Seed Powder	75 mg	5.8 g
Dates Powder	60 mg	1.8 g
Chia Seed Powder	50 mg	1.8 g
Flaxseed Powder	40 mg	1.8 g
Onion Extract	25 mg	1.5 g
Almond Powder	25 mg	1.2 g
Cashew Powder	25 mg	1.2 g
Rosemary Extract	1.5 mg	0.3 g
Corn Powder	108.5 mg	3.4 g
Total	410 mg	24.6 g

Methodology

The polyherbal nutraceutical capsule (Formulation) was prepared by doing conventional dry blending first, and then manual capsule filling. All raw ingredients came from verified suppliers and were handled according to Good Manufacturing Practices (GMP), so it was kept controlled. The entire formulation process went through a sequence of steps that basically looked like this

1. Collection of Raw Materials
All herbal parts, like fenugreek seed powder, curry leaf powder, ginger powder, sesame seed powder, flaxseed powder, onion extract, almond powder, zinc, and rice flour were collected from authenticated sources. Before using anything, the quality of each ingredient was checked carefully.
2. Drying
If any fresh herbal materials were used, they were washed properly, and then shade-dried at room temperature until moisture levels reduced. Proper drying matters because it helps curb microbial growth, and also supports stability for the final formulation.

3. Grinding
The dried plant materials were ground separately using a lab grinder so that fine powders were produced. Generally, smaller particle size makes mixing

easier and helps the ingredients distribute more evenly.

4. Sieving

Each powdered material was passed through a 60-mesh sieve, to achieve a similar particle size across the batch. Sieving helps remove the coarser fraction and improves the powder blend's flow characteristics.

5. Weighing

The exact amount of each ingredient was measured using a calibrated electronic analytical balance, based on the formulation composition (10 g batch).

6. Mixing

All weighed ingredients were blended thoroughly in a clean mortar and pestle, using geometric dilution, until a homogeneous powder blend was formed. Rice flour was used as an excipient, mostly to improve flow behaviour, and support steady capsule filling. This was targeted for the capsules, obviously.

7. Capsule Filling

The final powder blend was then filled manually into size 0 hard gelatin capsules using a capsule-filling device. After filling, the capsules were checked for uniformity of fill and for the proper locking mechanism, before they were moved forward.

8. Packaging and Storage

Lastly, the filled capsules were packed into airtight moisture-resistant containers and stored in a cool, dry area, away from direct sunlight. This step helps maintain stability and reduces moisture uptake, as much as possible.

Flow Chart of Method of Preparation:

Raw Material Collection
↓
Drying
↓
Grinding
↓
Sieving
↓
Weighing
↓
Mixing
↓
Capsule Filling
↓
Packaging and Storage

Advantages of the Preparation Method

This approach relies on a simple, economical process, which is good for day-to-day work, and honestly it feels practical. It's also quite fitting for smaller scale laboratory preparation, so you don't really have to arrange a huge setup in the first place. Another nice side is that it promotes uniform mixing of the components, so the blend doesn't end up looking patchy or uneven. The capsules that are made show good content uniformity and steady overall performance. Also, it helps keep the nutritional value of the herbal ingredients in good shape, so those beneficial compounds stay as intact as it can be, rather than being overly disturbed.

If it becomes necessary, you can even scale up for industrial manufacturing without too many headaches. Overall, this methodology follows standard pharmaceutical procedures for preparing polyherbal nutraceutical capsules, and it helps keep quality, uniformity, and stability of the final formulation under control.

Evaluation Tests

Evaluation of the Polyherbal Nutraceutical Capsule (Formulation) The prepared polyherbal nutraceutical capsule was checked in a pre-compression as well as post-compression way, mainly to see how the powder mixes behaved and how the final capsule felt. Basically, it's meant to figure out if the formulation has decent pharmaceutical traits, and also whether it stays within normal quality requirements. You can think of it like this, the tests are not only for formality, but to confirm the blend consistency. That way the finished product, remains within the required standards, without major surprises.

Organoleptic evaluation

Principle

This is kind of based on what you can sense directly from the capsules, mainly the sensory observation of their physical traits.

Procedure

First the capsules were checked visually for the appearance, colour, and texture. This was done under good lighting conditions, so the details looked clear, and not misleading.

Significance

- It helps to confirm the overall look and the acceptability of the capsules.
- It also allows you to catch visible defects or any odd abnormalities early on.
- Plus, it gives a first indication about the general product quality.

Moisture Content

Principle

Moisture content, basically shows how much water is actually in the powder or formulation. It sounds simple, but it matters.

Procedure

First a known quantity of the sample was weighed, pretty accurately, then it was dried using a suitable drying method. You keep going until a constant weight is reached, not just "about constant". After that, the reduction in mass (or loss in weight) was written down and used.

Formula

$$\% \text{ Moisture} = \frac{\text{Initial weight} - \text{final weight}}{\text{Initial weight}} \times 100$$

Significance

- Too much moisture can spoil stability, and overall quality can drop.
- It also helps to reduce microbial activity, and prevents deterioration over time.
- In the end, it is important for preserving the physical traits of the formulation, like how it behaves and holds its form.

Weight Variation Test

Principle

This test checks the evenness, of the capsule weights. Like how similar the individual ones are, to each other sort of.

Procedure

A set of twenty capsules was chosen randomly, then each one was weighed by itself, (one at a time). After that, the mean weight was calculated, and the weight of every single capsule was compared back against that average.

Formula

$$\text{Average Weight} = \frac{\text{Total weight of capsules}}{\text{Number of capsules}}$$

$$\% \text{ Deviation} = \frac{\text{Individual Weight} - \text{Average Weight}}{\textbf{Average Weight}} \times 100$$

Significance

- Makes sure the capsules are filled uniformly, in a proper way.
- Supports dosage consistency, so the effect stays near the same.
- Also, it can reveal differences during the capsule-filling step, when the process is running.

Disintegration Test

Principle

This disintegration testing is basically about figuring out how long it takes for a capsule to fall apart into smaller particles, once it is under the set conditions. It is not just a quick look, but a time thing.

Procedure

First, the capsules were placed one by one into the tubes of the disintegration device, with the required medium inside. Then the apparatus was set to run at the required temperature and movement. After that, the time needed until complete disintegration happened was written down. I mean recorded, exactly.

Significance

- It shows how well the capsule breaks down after you administer it, so basically it tells you what happens in the body.
- Also, it helps judge the readiness of the contents for the later dissolution stage.
- It supports dependable and repeatable behaviour for the dosage form overall.

Dissolution Test

Principle

Dissolution testing is about how soluble constituents come out of the capsule into the dissolution medium, kind of under controlled conditions.

Procedure

First the capsule was put in the dissolution apparatus, with a suitable dissolution medium inside that was kept at the required temperature. Then the apparatus was run at a fixed, predetermined speed, like as set earlier. Samples were taken out at certain time intervals and then analysed using an appropriate analytical method.

Formula

$$\% \text{ Release} = \frac{\text{Amount Released}}{\text{Total amount present}} \times 100$$

Significance

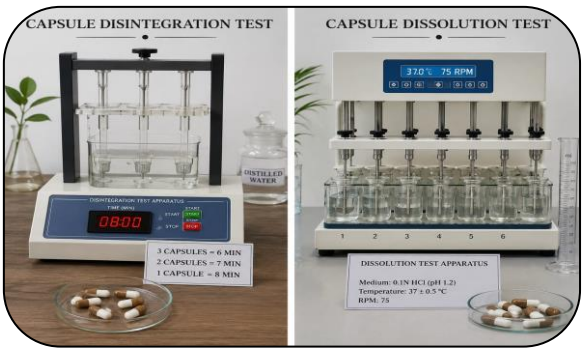
- It tells you about the release behaviour of the formulation.
- Also, it helps with checking how consistent the dosage form is.
- And it gives useful details on how available the soluble constituents are.

EVALUATION RESULTS

Parameter	Observation
Appearance	Smooth
Colour	Uniform brown
Texture	Smooth, fine & dry
Weight variation	500 ± 0.5 mg
Dissolution Test	37 ± 0.5°C
Moisture content	15 ± 0.5%
Disintegration Test	7 ± 0.5 min.









RESULTS & DISCUSSIONS

The prepared formulation was assessed with a sort of pile of pre filling and post filling parameters, kind a like you look at everything before and after. For the pre filling evaluation, the powder blend was checked in terms of particle size, bulk density, tapped density, angle of repose, Carr's index, Hausner ratio and moisture content. These measures kind a matter because they help you judge flowability, packing behaviour, uniformity and basically how fit the powder blend is for capsule filling.

Then after filling, the post filling evaluation covered organoleptic characteristics, weight variation, disintegration, dissolution and also a sensory evaluation. Taken together these tests are there to show the physical quality, uniformity, performance and acceptability of the final capsules, not only how they look on paper but also how they behave in practice. The organoleptic evaluation gives insight into the appearance, colour and texture of the capsules. When those characteristics land within the acceptable range it means the formulation has a decent physical look and it doesn't show obvious defects, like cracks or odd colour changes.

Moisture content is also a key quality parameter. Too much moisture can mess with powder flow, reduce stability and end up influencing the quality of plant derived ingredients. A suitable moisture level supports physical integrity and storage stability of the formulation. The weight variation test is used to check how uniform the filled capsules are. If the weight varies only slightly, it suggests better control of the filling process and more consistency among individual capsules.

For disintegration, the idea is to see how well the capsule breaks down after administration. Proper disintegration is important because it lets the powder contents become available for later dissolution.

In the dissolution test, you evaluate how soluble constituents are released from the capsule into the dissolution medium. If the dissolution profile looks satisfactory, it implies appropriate release behaviour of the dosage form under the chosen test conditions.

Overall, this evaluation gives a wide, comprehensive look at quality, consistency, physical properties and functional performance of the developed nutraceutical capsule. The blend of nutritional ingredients alongside plant derived phytochemicals provides a logical groundwork for creating a dietary supplement meant to support healthy hair and scalp.



FUTURE SCOPES

So, the future scope of the developed hair fall reducing dietary supplement capsule is basically more work, like extra research, some tweaking, and more development steps, so that safety, effectiveness, quality, and overall suitability can be confirmed for big scale production. It would make sense to run well planned clinical trials in order to test safety, how well people tolerate it, and how well it really helps supporting healthy hair while reducing hair fall. On top of that, more pharmacokinetic investigations can be done, to get a clearer picture of absorption, distribution, metabolism and excretion of the relevant bioactive constituents, and to see their bioavailability, plus how they behave in the body. The capsule formula itself can also be tuned further, by looking at things like composition, the dosage amount, capsule fill weight and the exact processing conditions. If stability improves, and the sensory acceptability also becomes better, then overall product quality should increase too, which helps in creating a more effective and more acceptable option. For industrial manufacturing, it's possible to set up a standardized manufacturing process along with proper quality control measures, so the quality stays consistent and batch-to-batch uniformity is maintained.

Then there's the more advanced part, like detailed phytochemical and nutritional profiling, plus studying the possible mechanisms of action and any synergistic effects among the ingredients. Long term safety studies may also be required, just to confirm it remains suitable for continued use. And finally, the needed quality, safety, and efficacy studies should be carried out, to satisfy relevant regulatory requirements and to help push development and potential commercialization of the product.

CONCLUSION

The present study was able to formulate a polyherbal nutraceutical capsule using Amla powder, Pumpkin seed powder, Dates powder, Chia seed powder, flaxseed powder, onion extract, almond powder (Biotin), Cashew powder, and Corn flour. The ingredients were chosen not only for their nutritional value but also for their reported potential to help support healthy hair growth, strengthen hair follicles, and in a practical way improve scalp health.

The prepared formulation displayed decent pre-compression and post-compression characteristics, so it should be suitable for capsule preparation and it also aligns with standard pharmaceutical quality requirements. The blend of proteins, vitamins, minerals, antioxidants, sulphur compounds, and omega-3 fatty acids in the formulation is expected to provide broad nutritional assistance for keeping hair healthy and, generally, reducing excessive hair fall.

In addition, the synergistic behaviour of the herbal components might assist keratin synthesis, boost scalp blood circulation, cut down oxidative stress, further nourish hair follicles, and encourage more firm, healthier hair development. Because it is made from natural ingredients, the formulation offers a safe and handy nutraceutical path, with limited risk of adverse effects when used as a dietary supplement.

Even so, the product is looking promising, but extra stability studies, more safety evaluations, and well-planned clinical trials are still required to verify its long-term efficacy, plus therapeutic advantages, in individuals who are dealing with hair fall.

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