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## FORMULATION EVALUATION OF THE MULTIFUNCTIONAL PARABEN FREE HERBAL SHAMPOO FROM HOUSEHOLD HERBS AND COMPARISON WITH THE COMMERCIAL SHAMPOOS

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### Keywords:

Shampoo, Herbal, Paraben free, Physico-chemical properties, Poly-herbal

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**ABSTRACT:** The study's objectives were to create a pure herbal shampoo, assess its physicochemical qualities, and compare them to those of commercially available synthetic shampoos. The formulation of the herbal shampoo involved combining readily accessible at-home extracts of Reetha, Henna, Neem, Amla, almond powders, Alovera gel and tulsi lemon juice to a 10% aqueous gelatin solution. The pH was then corrected with citric acid. Nine distinct formulations were created using various amounts of each herb's extract. To ascertain the physicochemical characteristics of both produced and marketed shampoos, a number of tests including visual inspection, pH, wetting time, percentage of solid components, foam volume and stability, surface tension, detergency, filth dispersion, *etc.*, were carried out. By giving 20 student volunteers a blind test, the conditioning effect of the herbal shampoo formulation was also assessed. The herbal shampoo was presented simply and appealingly. After 5 minutes, it demonstrated strong detergency and cleaning, low surface tension, tiny bubble size, and good foam stability. The homemade and store-bought shampoos displayed comparable findings for the percentage of solid ingredients. 3.0 out of 4 was the rating for the conditioning performance of the hair after using a herbal shampoo, compared to 3.4 and 3.3 for commercial synthetic shampoo. The outcomes showed that the specially made shampoo performed excellently in terms of conditioning, on par with shampoo readily accessible in stores. Nevertheless, more study and development are needed to increase its quality and safety.

**INTRODUCTION:** In our daily lives, shampoos are perhaps the most often used cosmetic items to clean our hair and scalp <sup>1</sup>.

A shampoo is essentially a detergent solution with appropriate ingredients for additional advantages like improved hair conditioning, lubrication, medicine, *etc.*

Many different types of shampoos are on the market today, including synthetic, herbal, medicated, and non-medicated varieties. Still, herbal shampoo is becoming increasingly popular among customers due to their perception that natural goods are risk-free and have no negative

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side effects<sup>2</sup>. Although synthetic surfactants are typically added to shampoo for foaming and washing purposes, frequent usage of these substances can cause dry hair, hair loss, scalp irritation, and eye discomfort<sup>3</sup>. Herbal shampoo alternatives are being researched, although it might be challenging to create cosmetics utilizing only natural ingredients<sup>4</sup>. Numerous medicinal herbs are known to have positive benefits on hair and are frequently used into shampoo formulations<sup>5</sup>. You can utilize these plant materials in powdered form, raw form, pure extract form, or derivative form<sup>6</sup>. The preparation of a herbal shampoo that is gentler and safer than synthetic products while yet competing favourably with their foaming, detergency, and solid content is exceedingly challenging. As a result, we thought of creating a pure herbal shampoo with locally accessible; historically around the world, herbal shampoo is a frequently used unstable product. It has been in use for a long time. The market is flooded with synthetic herbal shampoo nowadays<sup>7</sup>. Chemical herbal shampoo is made with a number of chemicals that may both treat hair problems and harm hair. According to certain international studies, cancer is also caused by the ingredients in herbal shampoo<sup>8</sup>. A surfactant (surface active material) preparation in an appropriate form, such as liquid, solid, or powder, is referred to as herbal shampoo. When used as directed, it will effectively remove surface grease, dirt and skin debris from the hair shaft and scalp without negatively affecting the user's hair, scalp, or health. Several variations of herbal shampoo include powder, liquid, lotion, cream, jelly, aerosol, and specialty varieties (Conditioning, Anti-dandruff, Baby, Two Layers). However, herbal shampoo will be the way of the future<sup>9</sup>. It includes herb extract in addition to all-natural components. It aids in the improvement of hair's hydration, gloss, growth, thickness and root strength. The main benefit of using herbal shampoo is no negative side effects. Amla, Reetha, Shikakai, Brahmi, Bhringaraj, Nagarmotha, Alovera and other natural ingredients are found in herbal shampoo<sup>10-12</sup>. Shampoo made from herbs will have a future market.

#### **Function of Ingredients<sup>13-15</sup>:**

**Amla:** It feeds hair and promotes development. It permits the natural hair oils and texture to be preserved, giving the hair a healthy sheen. It

regulates baldness. Fatty acids in it moisturize the hair. To eliminate dandruff and dryness on the scalp, fatty acids permeate the skin. It has antioxidant characteristics that help to strengthen the hair's roots. It works as a conditioner to provide bounce and gloss to hair.

**Reetha is a purifying agent that keeps** the scalp soft and eliminates any infection-causing microorganisms. It also keeps hair healthy and silky while nourishing it. It makes the hair shine and restores the texture of nature. Additionally, it helps with dandruff

**Aloe vera:** It promotes hair thickness. It also benefits hair nutrition.

**Lemon Juice:** It keeps the pH of HS stable. It imparts a scent to HS.

**Henna Leaf:** conditioner and hair growth

**Neem Leaf:** Prevent hair from becoming dry and brittle.

**Almond:** A demulcent, sedative, and preservative.

**Tulsi:** Antibacterial and lice-fighting qualities<sup>13-15</sup>

In order to develop a herbal shampoo that is both safe and effective, this study evaluated and compared its physicochemical qualities to those of commercially available synthetic and herbal shampoo.

#### **MATERIALS AND METHODS:**

**Sample Collection:** Most of the mixture's herbs utilized were accessible at home. For the manufacture of the shampoo, all materials were gathered and extracted. The remaining ingredients were all of the highest quality.

**Preparation of Plant Extracts:** All the materials were combined using the recipe. Reetha, Henna, Neem, Amla, almond powders, Alovera gel, and tulsi lemon juice were combined to make a decoction in one part water. By using a muslin cloth, filter the water. Gather filtrate. With continual stirring, the filtrate above was combined. Using mixed guar gum as a thickening ingredient helps keep herbal shampoo's viscosity close to its semisolid state. The final additions were preservatives and fragrance.

**Formulation of Herbal Shampoo:** The ratios of the plant extracts were blended to create the shampoo, whose composition is presented in **Table 1**. To a 10% gelatin solution, herbal extracts were added and the mixture was shaken for 20 min. Additionally, 1 mL of lemon juice was stirred in. In

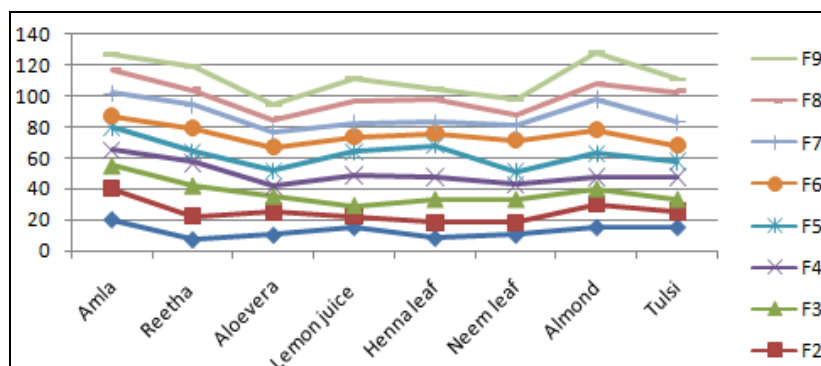
the end, enough 1% citric acid solution was added to the solution to change the pH. A few drops of rose essential oil were also added to the shampoo mixture to give it flavour and gelatin solution was used to adjust the amount to 100 ml as shown in **Table 1**.

**TABLE 1: % COMPOSITION OF HERBAL EXTRACT**

Materials	F1	F2	F3	F4	F5	F6	F7	F8	F9
Amla	20	20	15	10	15	7	15	15	10
Reetha	7	15	20	15	7	15	15	10	15
Aloevera	10	15	10	7	10	15	10	8	10
Lemon juice	15	7	7	20	15	10	8	15	15
Henna leaf	8	10	15	15	20	8	7	15	7
Neem leaf	10	8	15	10	8	20	10	7	10
Almond	15	15	10	8	15	15	20	10	20
Tulsi	15	10	8	15	10	10	15	20	8

**TABLE 2: FORMULA FOR SHAMPOO [50 ML]**

Materials	Quantity								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
Herbal Extract	30ml	30ml	30ml	30ml	30ml	30ml	30ml	30ml	30ml
Lemon juice	5ml	5ml	5ml	5ml	5ml	5ml	5ml	5ml	5ml
Gelatin solution	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Citric acid	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Essential oil	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s

**FIG. 1: GRAPHICAL REPRESENTATION OF % COMPOSITION OF HERBAL EXTRACT**

**Evaluation of Formulated and Commercial Shampoo:** Several quality control procedures, such as visual evaluation, physicochemical controls, and conditioning performance tests, were carried out to assess the quality of commercial and created formulations<sup>16</sup>.

**Physical Appearance/Visual Inspection:** The created formulation's capacity to produce foam, as well as its clarity, colour and odour, were assessed<sup>17</sup>.

**Determination of pH:** At room temperature, the pH of a 10% v/v shampoo solution in distilled water was determined using a pH metre (Mi 151, Martini Instruments). =

**Determination of % of Solid Contents:** In a previously clean, dry, and weighed evaporating dish, 4 grammes of shampoo were added. To check the precise weight of the shampoo, the dish and shampoo were weighed once again. By setting the evaporating dish on the hot plate, the liquid component of the shampoo was able to evaporate. After the shampoo had dried completely, the weight and percentage of the solid constituents were determined.<sup>18</sup>

**Dirt Dispersion Test:** In a big test tube, 10 mL of distilled water was mixed with two drops of shampoo. One drop of India ink was added to this mixture and the test container was then sealed and shook 10 times. The rubric, None, Light, Moderate,

or Heavy, showed how much ink was in the foam<sup>19</sup>.

**Surface Tension Measurement:** A stalagmometer was used to test the surface tension of 10% w/v shampoo in distilled water at room temperature<sup>20</sup>.

**Test to Evaluate Foaming Ability and Foam Stability:** Utilizing the cylinder shaking method, foaming capacity was evaluated. In a 250 mL graduated cylinder, 50 mL of the 1% commercial or designed shampoo solution was poured in and shaken ten times with one hand. After shaking for one minute, the total volume of the foam content was measured. By measuring the foam volume after a 1 and 4-minute shake test, foam stability was assessed<sup>21</sup>.

**Wetting Time Test:** Cut into discs with a 1-inch diameter and an average weight of 0.44 g, the canvas paper. The timer was activated when the smooth disc surface was put on the 1% v/v shampoo solution surface. The wetness time was recorded as the length of time it took for the disc to start to sink<sup>22</sup>.

**Evaluation of Conditioning Performance:** A neighbourhood salon provided an Indian woman's hair tresses. It was cut into four swatches of the tresses, each around 10 cm long and 5 g in weight. The control was a swatch that had not been washed. The other three tresses were cleansed similarly using commercial and designed shampoos. For each cycle, each tree was shaken for 2 minutes in a conical flask with a combination of 10 g of a sample and 15 g of water, then washed with 50 mL of water.

Following that, each tree was allowed to air dry at room temperature. The trees were washed a maximum of ten times. A blind touch test on twenty randomly selected student volunteers assessed the shampoos' conditioning efficacy, *i.e.*, smoothness and softness<sup>22</sup>. All students were blindfolded and instructed to touch and grade the four trees on a scale of 1 to 4 for conditioning performance (1 14 bad; 2 14 adequate; 3 14 outstanding; 4 14 great).

**Statistical Analysis:** SPSS v.19 was used to analyze the data. All experiments were carried out in triplicate, and data are presented as mean and

standard deviation. The ANOVA single-factor test was employed to determine significance. P values less than 0.05 were deemed significant.

## RESULTS AND DISCUSSION:

**Formulation of Herbal Shampoo:** A pure herbal and creates transparent solutions. To get the appropriate pH, citric acid was added. To keep the formulation's acidic pH, 1 mL of lemon juice was added as a natural antioxidant, chelating, and antidandruff agent. Lemon juice was used as a preservation ingredient in the shampoo. **Table 2** shows the final formula of the created shampoo.

**Evaluation of Shampoos:** The efficiency of the designed herbal and commercial shampoos was assessed using certain simple physicochemical tests, which are presented below. Shampoo was created by combining all of the extracts in the amounts stated in **Table 1**.

Saponins are natural surfactants with strong detergency and foaming capabilities in several plant materials. A decent shampoo must have enough viscosity to be easily removed from the container while not dripping down from the hair during usage. As viscosity builders, a number of natural materials are accessible. We chose a 10% gelatin solution for this since it has pseudo-plastic properties

**Physical Appearance/Visual Inspection:** Like any other cosmetic preparation, shampoo should be visually pleasing. Physical properties like colour, odour and transparency were assessed for shampoos developed and commercialized in **Table 3**. Our created shampoo was clear, pale green, and odourless.

**pH:** To reduce hair damage, most shampoos are either neutral or slightly alkaline in pH. Shampoo's pH also aids in reducing eye discomfort, improving hair quality and preserving the scalp's ecological balance (Baran and Maibah, 1998). The pH of commercial shampoos evaluated was determined to be within the desired range (between 7 and 5) (Tarun *et al.*, 2014), as shown in **Table 3**. Commercial shampoos had acid balanced values (Dove: 6.12, Herbal Essences: 6.04), while the pH of the designed shampoo was determined to be almost neutral (7.02).

**% of Solid Contents:** Shampoos with 20% 30% solid content are typically simple to apply and rinse from the hair. If there isn't enough solid, it will be excessively watery and wash away fast; similarly, too many solids will be difficult to work into the hair or wash out. The percent solid contents of all tested shampoos were determined to be between 22 and 25% and are predicted to wash off quickly

**Table 3.**

**Dirt Dispersion:** Dirt dispersion is a key parameter for assessing shampoo cleaning activity. Shampoos that cause the ink to concentrate in the foam are deemed low-quality because ink or filth that remains in the foam is difficult to rinse away and re-deposits on the hair. As a result, the dirt should remain in the water section for greater washing action. All shampoos concentrated the ink in the water section, guaranteeing enough cleaning capacity and actual efficacy.

**Surface Tension:** The phrase refers to the quantity of surfactant in shampoo that is used to lower surface tension. The greater the surface tension, the greater the cleansing effect of the shampoo. A shampoo is said to be of high quality if it reduces the surface tension of pure water from 72.28

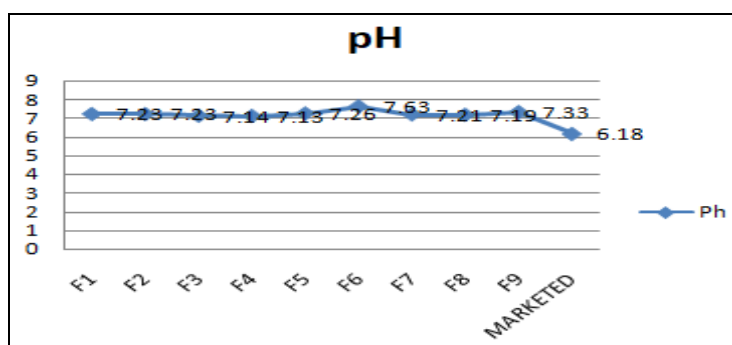
dyn/cm to around 40 dyn/cm. Surface tension was reduced in all of the shampoos tested, ranging from 31.68 to 38.72 dyn/cm. The decrease in surface tension indicates that they have good detergent activity. However, Dove® (31.68 dyn/cm) has the lowest surface tension of all the shampoos, suggesting that it has the best cleansing capacity. Excessive detergents in commercial synthetic or semi-herbal shampoos can remove the hair of up to 80% of its oil, causing damage. We have prevented this by using a gentle detergent in our shampoo.

**Foaming Ability and Foaming Stability:** Because foaming or lathering is vital to the consumer, it is considered significant criteria in shampoo assessment. Herbal Essences and designed shampoo achieved foam volumes greater than 100 mL (115, 113 mL, respectively), whilst dove shampoo produced a foam volume of 92 mL. The foams produced by the designed shampoo were tiny, compact, homogeneous, denser, and more stable than commercial samples. For 5 minutes, all of the shampoos tested had the same froth volume, indicating that their foam is stable. The Sheekakai may be responsible for the increased foaming feature of prepared shampoo.

**TABLE 3: PHYSIOCHEMICAL EVALUATION OF FORMULATED AND MARKETED PREPARATION**

Parameters	F1	F2	F3	F4	F5	F6	F7	F8	F9	Marketed
Colour	LB	LB	LB	LB	LB	LB	LB	LB	LB	WHITE
Odour	GD	GD	GD	GD	GD	GD	GD	GD	GD	GD
Transparency	OP	OP	OP	OP	OP	OP	OP	OP	OP	MW
Ph	7.03±0.09	7.23±0.29	7.14±0.13	7.13±0.5	7.26±0.4	7.63±0.09	7.21±0.18	7.19±0.29	7.33±0.02	6.18±0.23
%Solid Content	22±0.99	22±0.91	23±0.45	21±0.49	22±0.39	23±0.39	24±0.33	21±0.34	22±0.94	25±0.69
Foam Volume	115±0.22	113±0.22	113±0.33	110±0.12	114±0.23	113±0.52	112±0.32	114±0.72	115±0.12	105±0.59
Foam Type	Sd	Sd	Sd	Sd	Sd	Sd	Sd	Sd	Sd	Sa
Surface Tension	38±1.55	37±1.35	36±1.52	37±1.57	38±1.45	37±1.45	38±1.85	36±1.95	37±1.85	33±1.35
Wetting Time	185±5	182±5	182±5	181±5	187±5	189±5	186±4	189±5	188±5	157±5

LB = light brown; GD = good; OP = opaque; MW = milky white.



**FIG 2: COMPARATIVE EVALUATION OF PH WITH MARKETED PREPARATION**

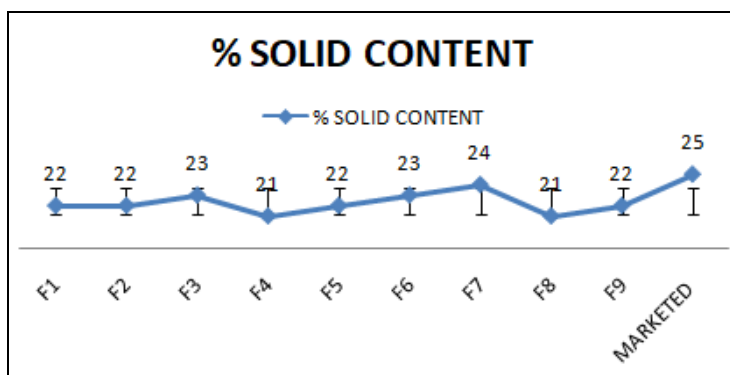


FIG. 3: COMPARATIVE EVALUATION OF % SOLID CONTENT WITH MARKETED PREPARATION

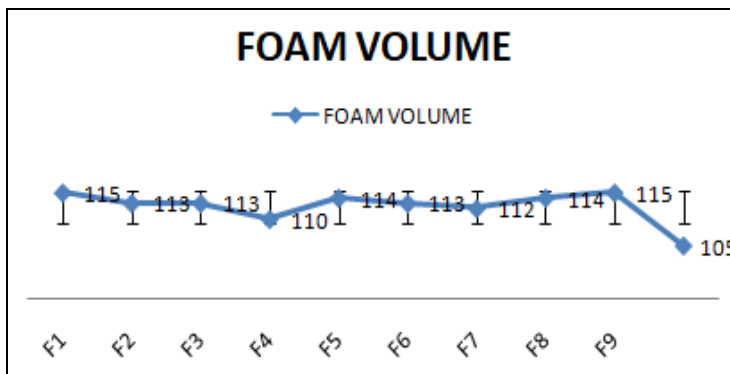


FIG. 4: COMPARATIVE EVALUATION OF FOAM VOLUME WITH MARKETED PREPARATION

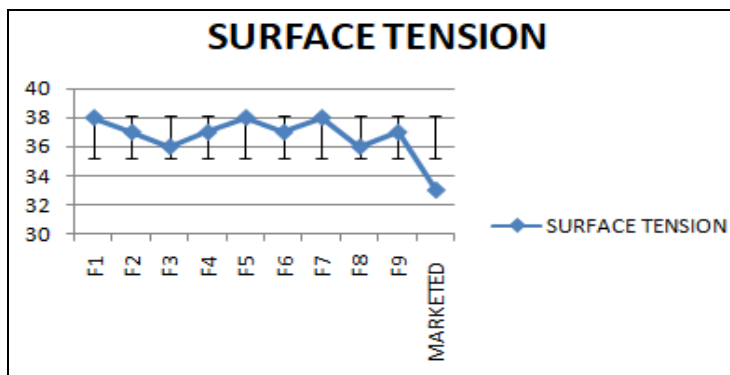


FIG. 5: COMPARATIVE EVALUATION OF SURFACE TENSION WITH MARKETED PREPARATION

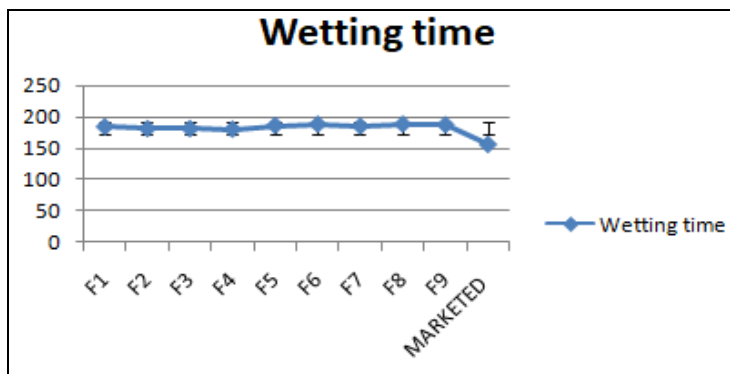


FIG. 6: COMPARATIVE EVALUATION OF WETTING TIME WITH MARKETED PREPARATION

**Wetting Time:** A surfactant's wetting ability is proportional to its concentration and is widely used to assess its efficacy. The canvas disc method is a rapid, effective, and dependable test for determining a shampoo's wetting capabilities. The

wetting time of three shampoos was shown to be on order 141 157.

**Conditioning Performance:** Table 3 shows the conditioning effectiveness of three shampoos based

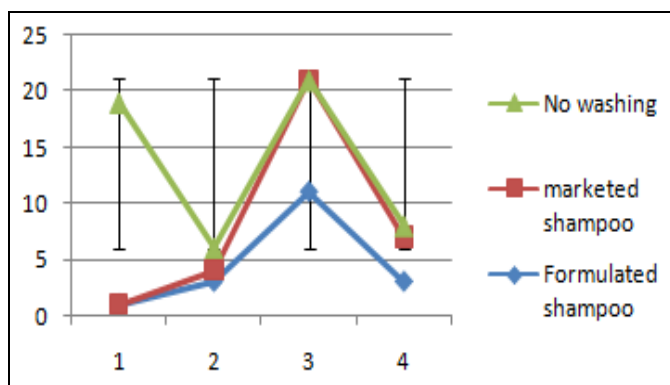
on the mean scores of student referees. Most students assessed the dove-washed trees as having the best conditioning performance, while the control trees (without washing) received the lowest score (1.1). The conditioning performance of the

tresses was determined to be 3.0 out of 4 when washed with the designed shampoo, which was equivalent to the scores of marketed shampoos. The findings clearly showed that the designed shampoo has a high conditioning efficacy.

**TABLE 4: THE MEAN SCORE OF THE STUDENT VOLUNTEERS OPINION ON THE CONDITIONING PERFORMANCE OF THE TRESSES AFTER TREATMENT WITH SHAMPOO (N=20)**

Score	Formulated shampoo	Marketed shampoo	No washing
1	1	0	18
2	3	1	2
3	11	10	0
4	3	4	1

Score 4=excellent, score 3= good , score 2 =fair and score 1 = poor



**FIG. 7: THE MEAN SCORE OF THE STUDENT VOLUNTEERS OPINION ON THE CONDITIONING PERFORMANCE OF THE TRESSES AFTER TREATMENT WITH SHAMPOO (N=20)**

**CONCLUSION:** The goal of this study was to create a fully herbal shampoo comparable to the synthetic shampoo on the market. We created a herbal shampoo by combining plant extracts that are frequently used historically and hailed for their hair-washing properties throughout India and are conveniently accessible at home. All the components used to make shampoo are safer than silicones and poly-quaternions, synthetic conditioning agents that can significantly reduce hair or protein loss during combing.

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