

## Original Article

# Effect of peppermint oil on hair growth and hair fall reduction in individuals with diffused hair loss: A randomized controlled study

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## ABSTRACT

**Introduction:** Diffuse hair loss is the condition where hair shedding is seen across the scalp in uniform distribution, which is the result of a disruption of one phase of the hair cycle. Up to 85% of males and 40% of females are affected by hair loss and its incidence increases with age for both sexes. Hair shedding in females is common and relating to the nutritional and endocrinal factors. **Aim:** The aim of the study is to evaluate the effect of peppermint essential oil mixed with coconut oil on hair fall reduction in individuals with unhealthy hair fall rate of over 200 strands of hair/day. The effect on hair density, itching of the scalp, hair growth, amount of noticeable new hair, visibility of the scalp and rate of hair loss in individuals is evaluated. **Materials and methods:** Sixty females aged 20.52±2.14 years were randomly allocated to either the study group or control group. The study group received head massage using peppermint oil mixed with coconut oil, whereas the control group received head massage using coconut oil for 2-3 minutes a day, 3 days a week for 1 month. Assessments were taken at before and after the intervention. Four Item Women's Hair Growth Questionnaire (FIWHGQ) was considered, and the Kolmogorov Smirnov test was used to check normality. Baseline and demographic details of study group and control group were compared by independent samples-t-test or Mann Whitney-U-test, and within-group analysis was done using paired samples t-test or Wilcoxon Signed Rank test based on the data distribution. **Results:** Hair count and itching: Within group analysis showed a significant increase in mid-pattern hair count ( $p = 0.034$ ) with an insignificant (slightly missed the level of significance) increase in frontal hair count ( $p = 0.096$ ) and vertex hair count ( $p = 0.056$ ) with the significant reduction in itching ( $p = 0.005$ ) in the study group, whereas the control group showed a significant increase in frontal hair count ( $p=0.001$ ) and no significant changes mid-pattern and vertex hair count and itching. However, between group analysis showed no significant difference between the study and control groups. **Conclusion:** Peppermint oil can be used as an alternative remedy for hair fall and itching of the scalp.

**Key words:** peppermint oil, hair loss, hair growth, scalp itching

Hair loss is a distressing condition that is associated with a multitude of natural, medical, or nutritional conditions, characterized by either the loss of hair density or hair thinning, or both [1]. In androgenic alopecia, the common form of hair loss, the dynamics of the hair cycle are altered leading to stepwise miniaturization of hair follicles which further leads to vellus transformation of hair follicles. The diffused pattern of hair shedding is caused due to the disruption of one phase of the hair cycle i.e., the anagen (active hair growth), catagen (involution), or telogen (resting). The anagen phase can last for 2-8 yrs, the catagen phase is seen for 4-6 weeks, and the telogen phase persists for 2-3 months. The exogen phase (release of dead hair) coincides with the end of the telogen phase. Most people have about 1,00,000 scalp hairs; normally 10-15% of these are in the telogen phase. Shedding of 100-150 telogen hairs per day is

normal [2]. The male population nearing 85% and females up to 40% are seen being affected by hair loss with further increasing incidences with age for both sexes. In India, the prevalence of Male Pattern hair loss and Female Pattern hair loss showed varied amino acid (essential and nonessential) and micronutrient deficiencies (zinc and copper) [3].

Currently, there are several kinds of therapeutic modalities available that cause hair regrowth and control hair loss. These comprise the 2-5% topical minoxidil, finasteride, and antifungal agents. Although, the limited therapeutic efficacy of these drugs is seen as it may cause serious side effects like loss of libido, erectile dysfunction, and gynecomastia [4]. Hair transplantation, a useful tool for androgenic alopecia produces potential complications like edema (5%), bleeding (0.5%), folliculitis, numbness of the scalp, epidermal cysts, and infection [5]. The International Organisation for

### Access this article online

Received – 22<sup>nd</sup> October 2024  
Initial Review – 31<sup>st</sup> October 2024  
Accepted – 30<sup>th</sup> January 2025

Quick response code

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Standardization (ISO) (ISO/DIS9235.2) defines an essential oil to be a product synthesized by employing distillation using water or steam, or processing mechanically, or dry distillation of natural materials. They appear as liquid, volatile, limpid, and coloured mixtures composing several aromatic compounds [7]. Traditional plant remedies have been used for centuries in the treatment of hair loss, but only a few have been scientifically evaluated.

Peppermint (*Mentha piperita*) belongs to the mint family, containing chemical constituents like limonene, cineole, menthone, menthofuran, isomenthone, menthyl acetate, isopulegol, menthol, pulegone and carvone. Of these, the major component is menthol (50-60%). Menthol has a cooling effect that decreases itching caused by histamine [8]. Peppermint oil is being utilized in the treatment of dermatological conditions as well as in the sectors of nutraceuticals, cosmetics, and postoperative adjuvant therapy [9]. The hair growth is facilitated by the conservation of vascularization of hair dermal papilla which is seen to be promoted by PEO, and this results in the induction of early anagen stage. The anti-inflammatory, antimicrobial, and antioxidant activity of peppermint oil effectively stimulated hair growth in an animal model via several mechanisms and thus could be used as a therapeutic or preventive alternative medicine for hair loss in humans [8, 9].

In many regions of the world, coconut oil is frequently used to moisturize the skin, maintain the health of the scalp, and cure hair damage through a direct or indirect mode of action [10]. Studies describing the hair growth activity of peppermint oil are limited and no known studies reported the effect of peppermint oil mixed with coconut oil on hair fall reduction in humans. Hence, the study aimed to evaluate the effect of PEO mixed with coconut oil on hair fall reduction in individuals with unhealthy hair fall rate of over 200 strands of hair/day.

## MATERIALS AND METHODS

This is a parallel-group randomized controlled trial. A total of 60 females aged  $20.52 \pm 2.14$  years with diffuse hair loss ( $>200$  strands/day) were recruited from a medical college and hospital located in south India using convenient sampling techniques. Participants were randomly allocated to either the study group or the control group. The study group received a head massage using peppermint oil mixed with coconut oil, whereas the control group received a head massage using coconut oil for 2-3 minutes a day, 3 days a week for 1 month. Assessments were taken before, and after the intervention.

The study was conducted at Department of Manipulative Therapies, Government Yoga and Naturopathy Medical College and hospital (GYNMC&H), Chennai, Tamilnadu, India. Institutional ethics committee clearance was obtained from GYNMC&H before the recruitment of the first participant. Study protocol was explained to the subjects and a

signed consent was obtained from each subject. Females with hair fall of more than 200 strands per day or hair thinning for over a period of 3 months were included in the study. Females with a healthy 100 strands per day rate of hair fall or under medication for any systemic disorders like anemia, thyroid disorders, endocrine disorders, fungal or parasite infection, cancer, autoimmune disease, and diabetes, and those who were not willing to participate were excluded from the study.

**Sample size:** Sixty subjects aged  $20.52 \pm 2.14$  years participated in the study. Sample size calculation was not made based on the previous study as there is random variation in results, which is one of the limitations of the study.

**Randomization and Blinding:** Sixty subjects were randomly allocated (1:1 ratio) to either the study group ( $n=30$ ) or the control group ( $n=30$ ) using a simple random method by computerized randomization. Allocation concealment was done using sequentially numbered opaque sealed envelopes. Randomization was done by an author who was not directly involved in the data collection or intervention.

**Intervention:** Study group subjects received head massage using coconut oil (5ml) mixed with peppermint essential oil (1ml) for 2-3 minutes a day, three days a week, for a period of one month. Subjects of control group received head massage using coconut oil (5 ml) without peppermint oil for 2-3 minutes a day, three days a week, for a period of one month.

### Outcome measures:

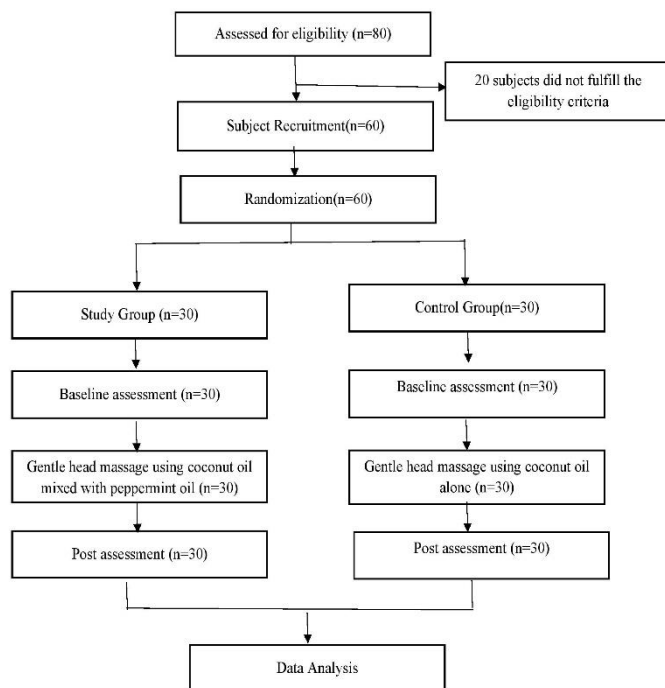
**Hair density:** The number of hairs per square centimeter in the frontal, midpattern and vertex area were measured using 5x scale LED analyser magnifying glass hair densitometer (Prosmar concepts, India) with a 1cm square scale is used to count before and after the intervention.

**Itching of the scalp:** It was measured using Visual Analogue scale (VAS) before and after the intervention. All the patients were instructed to indicate their itching intensity on a 10-cm horizontal long line, where 0 indicates no itching and 10 indicates very severe itching.

**Rate of hair fall and hair growth:** It was assessed using a 4-Item Women's Hair Growth Questionnaire (WHGQ) after the intervention including 1) Growth of hair 2) Amount of noticeable new hair, 3) Visibility of the scalp and 4) Rate of hair loss.

**Statistical Analysis:** The statistical analysis for this study was conducted using SPSS, and the Kolmogorov Smirnov test was used to check normality. Baseline and demographic details of the study group and control group were compared by independent samples-t-test or Mann Whitney-U-test, and within-group analysis was done using paired samples t-test or Wilcoxon Signed Rank test based on the data distribution. The effect sizes were calculated to estimate the magnitude of the treatment effects. All statistical tests will be conducted with a

two-tailed approach to ensure a comprehensive evaluation of the outcomes.



**Figure 1: Trial profile**

## RESULTS

The study was conducted between June 2022 and December 2023. Of the eighty participants screened for eligibility, 20 participants did not fulfil the eligibility criteria, hence 60 participants were recruited for the study. None of the participants dropped out of the study. No significant difference was found in all variables between the groups at baseline (Table 1).

**Hair count and itching:** Within-group analysis showed a significant increase in mid-pattern hair count ( $p = 0.034$ ) with an insignificant (showed a trend toward significance) increase

in frontal hair count ( $p = 0.096$ ) and vertex hair count ( $p = 0.056$ ) with the significant reduction in itching ( $p = 0.005$ ) in the study group, whereas the control group showed a significant increase in frontal hair count ( $p=0.001$ ) and no significant changes mid-pattern and vertex hair count and itching. However, between group analysis showed no significant difference between the study and control groups.

### Responses to Four Item Women's Hair Growth Questionnaire (FIWHGQ) given in Table 3:

**Question no 1 (From the start of my treatment, the growth of my hair has):** In the study group, 30% and 27.6% responded that their hair growth has slightly increased and moderately increased respectively, whereas in control group 43.3% and 36.7% responded their hair growth has slightly increased and moderately increased respectively.

**Question no 2 (From the start of my treatment, the amount of new noticeable hair has):** In the study group 36.7 and 26.7% responded that their noticeable new hair has slightly increased and moderately increased respectively, whereas in control group 50% participants responded that their noticeable new hair has slightly increased with 16.7% participants showing no noticeable new hair.

**Question no 3 (From the start of my treatment, the visibility of the scalp has):** 43.3% and 40% of the study group participants responded that the visibility of the scalp has slightly reduced and not changed respectively, whereas in the control group 50% and 26.7% of participants responded that their visibility of scalp has not changed and slightly reduced respectively.

**Question no 4 (Since the start of my treatment, the rate of hair loss has):** 40% of the participants in the study group responded that their rate of hair loss has slightly reduced and 16.7% responded that their rate of hair loss has moderately and greatly reduced, whereas in control group, 36.7% and 30% of participants responded that the rate of hair loss has not changed and slightly reduced respectively.

**Table 1: Baseline and demographic details of the Study Group and Control Group**

Variable	Study Group (n=30)	Control Group (n=30)
Age (years)	19.97± 2.09	21.07± 2.07
Gender	Female (n=30)	Female (n=30)
FHC (no. of hairs/ sq. cm)	143.00±34.95	141.87±27.71
MPHC (no. of hairs/ sq. cm)	161.10±26.80	161.07±21.62
VHC (no. of hairs/ sq. cm)	177.37±26.26	177.80±25.25
VAS	1.30±0.75	1.10±0.80

**Note:** All values are in mean ± standard deviation except gender. FHC-frontal hair count; MPHC- midpattern hair count; VHC -vertex hair count; VAS-visual analogue scale

Table 2: Pre and Post analysis of Study and Control group

Parameters	Study group		Control group		Between groups analysis	
	Pre-test	Post-test	Pre-test	Post-test	t/z/F value	p-value
FHC (no. of hairs/ sq. cm)	143.00±34.95	149.00±26.00	141.87±27.71	153.33±23.28	z = 1.147	p = 0.251
	z = 1.667; p = 0.096		z = 3.283; p = 0.001			
MPHC (no. of hairs/ sq. cm)	161.10±26.80	166.60±25.21	161.07±21.62	165.73±20.22	z = 1.132	p = 0.257
	z = 2.120; p = 0.034		z = 1.559; p = 0.130			
VHC (no. of hairs/ sq. cm)	177.37±26.26	183.73±28.94	177.80±25.25	177.20±23.54	t= 0.846	p =0.401
	z = 1.990; p = 0.056		z = 0.138; p = 0.891			
VAS	1.30±0.75	0.80±0.61	1.10±0.80	0.90±0.61	F= 4.257	p =0.044
	z = 6.719; p =0.000		z = 1.4281; p = 0.153			

Note:FHC-frontal hair count;MPHC- midpattern hair count; VHC -vertex hair count; VAS-visual analogue scale

Table 3: Study and Control subjects' response to 4 item women's hair growth questionnaire

Questions	Response	Study group frequency (%)	Control group frequency(%)
1.Since the start of my treatment, the growth of my hair has	greatly increased	5 (16.7)	0
	moderately increased	8 (26.7)	11 (36.7)
	slightly increased	9 (30)	13 (43.3)
	not changed	4 (13.3)	2 (6.7)
	slightly reduced	2 (6.7)	2 (6.7)
	moderately reduced	2 (6.7)	2 (6.7)
	greatly reduced	0	0
2.Since the start of my treatment, the amount of noticeable new hair has	greatly increased	0	0
	moderately increased	8 (26.7)	4 (13.3)
	slightly increased	11 (36.7)	15 (50)
	not changed	6 (20)	5 (16.7)
	slightly reduced	5 (16.7)	5 (16.7)
	moderately reduced	0	1 (3.3)
	greatly reduced	0	0
3.Since the start of my treatment ,the visibility of scalp has	greatly increased	0	0
	moderately increased	0	1 (3.3)
	slightly increased	2 (6.7)	2 (6.7)
	not changed	12 (40)	15 (50)
	slightly reduced	13 (43.3)	8 (26.7)
	moderately reduced	2 (6.7)	4 (13.3)
	greatly reduced	1 (3.3)	0
4.Since the start of my treatment, the rate of hair loss has	greatly increased	0	0
	moderately increased	0	1 (3.3)
	slightly increased	0	1 (3.3)
	not changed	8 (26.7)	11 (36.7)
	slightly reduced	12 (40)	9 (30)
	moderately reduced	5 (16.7)	6 (20)
	greatly reduced	5 (16.7)	2 (6.7)

## DISCUSSION

The critical study findings include that the Peppermint oil (PEO) significantly increased the mid-pattern hair count with a trend towards (an insignificant) increase in the frontal hair

count and vertex hair count with the significant reduction in itching. Whereas, the control group showed a significant increase only in the frontal hair count with no significant changes in rest of the variables. It indicates that peppermint oil was effective not only in improving the hair density but also in



reducing the itching that was associated with their hair fall. The study group subjects reported that their hair growth has increased slightly and moderately, the amount of new noticeable hair has increased moderately, visibility of the scalp and the rate of hair loss have reduced slightly, whereas the control group subjects reported that their hair growth and the amount of new noticeable hair have increased slightly with no noticeable changes in visibility of the scalp and rate of hair loss. It suggests that peppermint oil was effective in not only improving the hair growth but also in reducing the hair fall, whereas the coconut oil was effective only in increasing the hair growth without reducing the noticeable hair fall.

The effect of PEO application might be attributed to the following mechanisms: The topical application of peppermint produces pleasant, cooling sensation and helps to reduce skin inflammation. Menthol, a component of peppermint oil possesses antimicrobial, antioxidant and anti-inflammatory property. It helps to reduce scalp itching by balancing the scalp microbiome and activating A-delta fibers and *k*-opioid receptor [11]. PEO enhances blood circulation to the skin, thereby increasing the thickness of dermal layer, follicle number, and its rooted depth. A study in microvascular research found that 4% menthol solution caused blood vessels to widen and increases blood flow to scalp. PEO alters the skin permeability by stimulating the hair dermal papilla for vascular formation, inducing the hair growth.

On the scalp, using a few drops of organic PEO in combination with hair oil increases blood flow and encourages the healthy hair growth [12, 13]. It has been found that topical application of PEO after 4 weeks showed to induce very thick and long hair along with the elongation of hair follicles from the epidermis. It can be used as a therapeutic or preventive alternative medicine for hair loss in humans [13]. Coconut oil is a triglyceride of lauric acid which has a high affinity for hair proteins and has the ability to penetrate inside the hair shaft [14]. In the Indian subcontinent, coconut oil is widely used for hair treatment. It is a great conditioner and aids in the process of damaged hair growing back. Moreover, it offers the crucial proteins needed to nourish and repair harmed hair. Studies suggests that coconut oil offers hair stronger defence against fatigue-related hair damage [15].

This shows that coconut oil repairs the damaged hair and enhances hair growth. When mixed with essential oils like peppermint oil, it is more beneficial in the hair growth treatment. This suggest that peppermint could effectively reduce the scalp itching and reduce the rate of hair fall and enhances hair growth. The following were the strength of the study: effective randomization, equally distributed group of subjects, significant improvement in outcome variable and no adverse reactions occurred during study. Limitations are smaller sample size, lack of male participants blinding was not possible and sample size calculation was not made based on the previous study and the self-reported nature of hair fall.

## FUTURE DIRECTION OF THE STUDY

Study can be conducted with larger sample size. A multi-armed study comparing Peppermint oil and other essential oils in treating Hair fall.

## CONCLUSION

Peppermint oil is effective improves hair growth and reduce the hair fall while the coconut oil aids in conditioning the hair in increasing the hair growth. Peppermint oil mixed with coconut oil is cost-effective and alternative remedy for reducing hair fall and itching.

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**How to cite this article:** Malarvizhi S, Y. Deepa, Muthulakshmi. M, Saranya. P, Edmin Christa, A. Mooventhana. Effect of peppermint oil on hair growth and hair fall reduction in individuals with diffused hair loss: A randomized controlled study. *Indian J Integr Med*. 2025; Online First.

*Funding: None;*

*Conflicts of Interest: None Stated*