

# Effect of *Tectona grandis* Linn. seeds on hair growth activity of albino mice

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## ABSTRACT

The seeds of *Tectona grandis* Linn. are traditionally acclaimed as hair tonic in the Indian system of medicine. Studies were therefore undertaken in order to evaluate petroleum ether extract of *T. grandis* seeds for its effect on hair growth in albino mice. The 5% and 10% extracts incorporated into simple ointment base were applied topically on shaved denuded skin of albino mice. The time required for initiation of hair growth as well as completion of hair growth cycle was recorded. Minoxidil 2% solution was applied topically and served as positive control. The result of treatment with minoxidil 2% is 49% hair in anagenic phase. Hair growth initiation time was significantly reduced to half on treatment with the extracts compared to control animals. The treatment was successful in bringing a greater number of hair follicles (64% and 51%) in anagenic phase than standard minoxidil (49%). The results of treatment with 5% and 10% petroleum ether extracts were comparable to the positive control minoxidil.

**Key words:** Alopecia, hair growth, *Tectona grandis*, tick seeds

## INTRODUCTION

Hair loss is a dermatological disorder that has been recognized for more than 2000 years. It is common throughout the world and has been estimated to affect nearly 2% of the world's population.<sup>[1]</sup> Apart from metabolic and hereditary causes, alopecia has been observed as a major side effect of anticancer, immunosuppressant and many others drug treatments. Presently, minoxidil (useful in both male and female pattern baldness)<sup>[2]</sup> and finasteride (useful in male pattern baldness)<sup>[3]</sup> are the two USFDA approved synthetic drugs finding concomitant use for treatment of androgenic alopecia, although their side effects have abbreviated their usage.

Natural products are unequivocally advocated in the cosmetic and hair care industry and about 1000 different plant extracts have been examined with respect to hair growth activity; proanthocyanidine from grape seeds (*Vitis vinifera*) and [beta]-sitosterol in saw palmetto (*Serenoa serrulata*) have shown remarkable effect.<sup>[4]</sup> There are many products available prepared by combination of one or more herbal drugs that find acceptability as hair tonics, hair growth promoters, hair conditioners, hair cleansing agents, antidandruff agents and for the treatment of alopecia and lice infection.<sup>[5]</sup>

The traditional system of medicine in India acclaims a number of herbal drugs for hair growth promotion. However, lack of sound scientific evidence limits their use. The seeds of *Tectona grandis* (teak tree) have been recommended as a hair growth promoter in traditional literature.<sup>[6]</sup> The fatty oil from the seeds of the plant has reportedly been used by tribes for preventing premature hair loss.<sup>[6]</sup> *T. grandis* has also been described to be useful as a hypoglycemic agent.<sup>[7]</sup> According to Ayurveda, *T. grandis* wood is acrid, cooling, laxative, sedative to gravid uterus and useful in treatment of piles, leukoderma and dysentery. The roots are useful in anuria and retention of urine. The flowers are acrid, bitter dry and cure bronchitis, biliousness, urinary discharge, etc. According to the Unani system of medicine, the oil is useful in scabies, whereas wood is used for headache, biliousness, burning pains and pain, liver problems. It allays thirst, and acts as anthelmintic, expectorant and anti-inflammatory.<sup>[6,8]</sup> The bark is astringent,

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Figure 1: Rats of control group

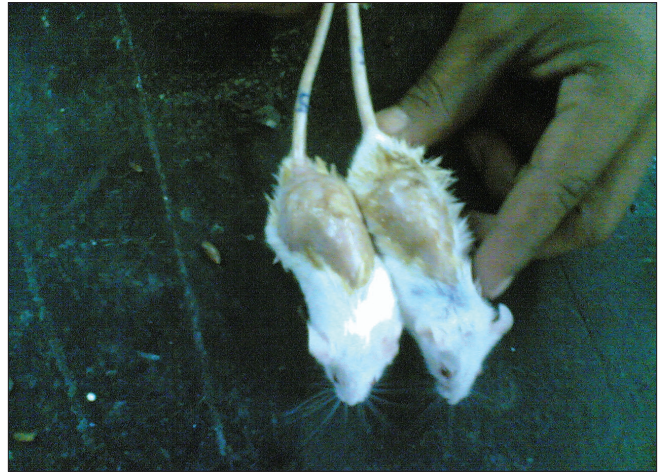


Figure 2: Rats treated with 5% extract



Figure 3: Rats treated with 5% extract + 2% minoxidil



Figure 4: Rat treated with 2% minoxidil



Figure 5: Rats treated with 10% extract + 2% minoxidil



Figure 6: Rats treated with 10% extract

acid, cooling, constipating, anthelmintic and depurative. It is useful in bronchitis, hyperacidity, vitiated conditions of *pitta*, dysentery, verminosis, diabetes, leprosy and skin diseases.<sup>[6]</sup>

*T. grandis* is known as *saka* in Sanskrit, *sagun* in Hindi, *sagwan* in Marathi and *teak tree* in English.<sup>[8]</sup> Lapachol, a naphthaquinone isolated from the roots of *T. grandis*, has an

antiulcerogenic effect in rats and guinea pigs.<sup>[9]</sup> *T. grandis* sawdust extract inhibited the growth of *Aspergillus niger* and the active compounds were identified as deoxylapachol and tectoquinone.<sup>[10]</sup> *T. grandis* has been investigated for nitric oxide scavenging activity<sup>[11]</sup> and wound healing activity in rats.<sup>[12]</sup> Tannin found in this plant has anti-inflammatory effects and is used topically for treatment of burn wounds.<sup>[13]</sup>

In the present study, the effect of petroleum ether extract of *T. grandis* Linn. seeds was investigated on hair growth initiation and promotion.

## MATERIAL AND METHODS

### Plant material

*T. grandis* seeds were procured from our campus area (Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha) and authenticated by a local botanist. Fine powder of the drug was used for the purpose of extraction.

### Preparation of extracts

The dried fine powder of *T. grandis* seeds was fed in a percolator and extracted with petroleum ether (60–80°C) till completely exhausted. After percolation of 50 g powder of *Tectona* seeds in one session, 8 g extract was obtained. We processed a total of 500 g powder.

### Animals

Albino mice of either sex of age 21 days,<sup>[14]</sup> weighing between 25 and 30 g, were fed on the standard diet and water *ad libitum*. The animals were housed at room temperature (24 ± 2°C) on a normal day–night cycle (06:00–18:00 hours).

### Preparation of samples

The petroleum ether extract was mixed in a simple ointment base at a concentration of 5% and 10%. The simple ointment base consisted of soft paraffin 8.5 g, hard paraffin 1 g, and linoline 0.5 g mixed in a Petri dish and kept in hot water bath to convert it into liquid state and then cooled.

### Treatment

Animals were divided into six groups of six mice each as follows: Group I was administered vehicle only and served as control; Group II received topical application with 2% solution of minoxidil; Group III was administered topical application of 5% petroleum ether extract in ointment base; Group IV received topical application of 5% petroleum ether extract in ointment base plus 2% minoxidil; Group V was administered topical application of 10% petroleum ether extract in ointment base and Group VI topical application of 10% petroleum ether extract in ointment base plus 2% minoxidil.

Using a hair removing cream (Anne French), hair in an area of 4 cm<sup>2</sup> on the dorsal side of the mice were removed.

### Toxicity studies

Toxicity studies were carried out and the petroleum extract when applied in a concentration of up to 10% did not show any toxic side effects like erythema on skin surface. Thus, the prepared extracts were considered safe for topical application.

Permission from the institutional ethical committee was taken before starting animal experiment.

### Qualitative hair growth study

Qualitative hair growth was evaluated by visual observation of two parameters: a) hair growth initiation time, i.e., minimum time to initiate perceptible hair growth and b) hair growth completion time, i.e., minimum time taken to cover the denuded skin region with new hair completely.<sup>[15]</sup> Hair growth initiation and completion time was recorded for each group of animals.

### Quantitative hair growth study

The method reported by Uno (1991)<sup>[16]</sup> was followed for the quantitative evaluation of *T. grandis* extract. One mouse from each group was euthanized after 30 days of treatment. Skin biopsies were taken from the shaved area and the specimens were preserved in 10% formalin. The specimens were fixed in paraffin wax and blocks prepared for microtomy. After fixation, vertical sections of the skin were cut with the help of semiautomatic rotary microtome (Remi-1871, India).

The sections were stained with hematoxylin and eosin. The number of hair follicles per millimeter area of skin and the ratio of hair follicles in different cyclic phases, i.e., anagen (active growth phase) and telogen (resting phase) were determined using the microscope. Hair folliculogram was prepared by observing growth cycle of 100 hairs and length of hair follicle.

### Statistical analysis

Data are reported as mean ± SD. Statistical analysis of data was carried out by analysis of variance (ANOVA) test.

## RESULTS

### Qualitative studies on hair growth

Hair growth initiation and completion time was considerably reduced upon treatment with petroleum ether extract of *T. grandis*. In the control group animals, hair growth was initiated in denuded area in the 2nd week, whereas it was noted in the 1st week in the petroleum ether extract treated groups and minoxidil treated groups. Hair growth was initiated on the 5th day with 5% ointment of petroleum ether extract of *T. grandis*. Hair growth initiation was recorded on the 4th day with ointment of 5% *T. grandis* plus 2% minoxidil, whereas it was on the 7th day with 10% ointment of *T. grandis* plus 2% minoxidil. With only 10% ointment of *T. grandis*, hair growth

initiation was observed on the 10th day, while it was observed on the 6th day in the minoxidil treated group and on the 12th day in the control group.

The time taken for complete hair growth on the shaved area was also influenced by the petroleum ether extract of *T. grandis*. Complete hair growth was observed on the 18th day with 5% extract and on the 15th day with 5% extract plus 2% minoxidil. It was observed on the 22nd day with 10% petroleum ether extract treatment, on the 20th day with 10% petroleum ether extract plus 2% minoxidil, and on the 18th day with minoxidil treatment. In vehicle control group animals, complete hair growth was noted after 25 days [Figures 1-6].

The results clearly show that the extract was successful in reducing the time taken for hair growth initiation and completion. The results further suggest that petroleum ether extract of *T. grandis* has better activity compared to minoxidil as far as hair growth initiation and completion is concerned.

Results are summarized in Tables 1 and 2.

### Length of hair follicles

Treatment with 5% and 10% petroleum ether extract of *T. grandis* had a remarkable effect on the length of hair follicles. In the control group, only  $34 \pm 0.4\%$  had an average length of 0.5 mm, whereas in the extract treated groups  $46 \pm 0.3\%$  and  $48 \pm 0.1\%$  hair population with more than 0.5 mm was observed with 5% and 10% extract treatment, respectively. The results of treatment were comparable with the minoxidil group where

$49 \pm 0.1\%$  hair population had a length of 0.5 mm and above.

## DISCUSSION

Topical application with the petroleum ether extract of *T. grandis* seeds reduced the time required for hair growth initiation and was superior to standard (minoxidil 2%) solution. 5% of *T. grandis* extract with minoxidil was more effective than any single drug. The quality of hair in the petroleum ether extract treated group was coarse, rough and hard, whereas the minoxidil treated group resulted in soft and silky hair. Petroleum ether extract was the best in inducing hair growth initiation, and the minoxidil treatment comes next. The study confirms that the petroleum ether extract (5%) treatment is at par with 2% minoxidil treatment in revitalizing the growth of hair in mice. The remarkable improvement in length of hair follicles also supports the hair growth promoting effects of the herb.

Androgenetic alopecia (AGA) is a dihydrotestosterone (DHT) mediated process characterized by continuous miniaturization of androgen reactive hair follicles and accompanied by perifollicular fibrosis of follicular units in histological examination.<sup>[17]</sup> Retention of late anagenic follicles as well as increase in follicular length and prevention of their miniaturization may therefore be attributed to 5-alpha-reductase inhibitory activity, although detailed investigations in this regard are necessary to explore the possibility of this mechanism.

**Table 1: Effect of *Tectona grandis* seed extract on qualitative hair growth**

Treatment (topical)	Hair growth (days)	
	Initiation time	Completion time
Control (vehicle only)	$12 \pm 0.82$	$25 \pm 1.02$
Standard (2% minoxidil solution)	$6 \pm 0.41^{***}$	$18 \pm 1.08^{***}$
5% extract	$5 \pm 0.28^{***}$	$18 \pm 0.56^{***}$
10% extract	$10 \pm 0.12^*$	$22 \pm 1.04$
5% extract + 2% minoxidil solution	$4 \pm 0.20^{***}$	$15 \pm 0.41^{***}$
10% extract + 2% minoxidil solution	$7 \pm 0.82^{**}$	$20 \pm 0.58^{**}$

\* $P < 0.05$ , \*\* $P < 0.01$  and \*\*\* $P < 0.001$  significance vs. control

**Table 2: Quantitative studies on hair growth (telogenic phase, anagenic phase)**

Treatment	After 30 days (% of hair follicles)		
	Telogen	Anagen	Ratio
Control (vehicle only)	$71 \pm 0.3$	$29 \pm 0.3$	2.44
Standard (2% minoxidil solution)	$51 \pm 0.5$	$49 \pm 0.5^*$	1.04
5% <i>T. grandis</i> seed extract	$36 \pm 0.2$	$64 \pm 0.2^{***}$	0.56
10% <i>T. grandis</i> seed extract	$49 \pm 0.2$	$51 \pm 0.5^{**}$	0.96
5% <i>T. grandis</i> seed extract + 2% minoxidil solution	$28 \pm 0.2$	$72 \pm 0.3^{***}$	0.38
10% <i>T. grandis</i> seed extract + 2% minoxidil solution	$41 \pm 0.6$	$49 \pm 0.6^{**}$	0.83

\* $P < 0.05$ , \*\* $P < 0.01$  and \*\*\* $P < 0.001$  significance vs. control

The present study validates the ethnomedical use of plants for hair loss treatment. Further studies on utilization of the petroleum ether extract and its incorporation in a formulation are warranted for commercial utilization of *T. grandis*.

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