

**EVALUATION OF HAIR GROWTH PROMOTING POTENTIAL OF *DURDHURADI TAILA* THROUGH MODULATION OF 5 $\alpha$ -REDUCTASE GENE EXPRESSION**Akarsha Krishna S.<sup>\*1</sup>, Ashwin Kumar S. Bharati<sup>2</sup><sup>\*1</sup>PG Scholar, <sup>2</sup>Professor, Department of Agada Tantra, Sri Dharmasthala Manjunateshwara College of Ayurveda and Hospital, Hassan.**\*Corresponding Author: Akarsha Krishna S.**PG Scholar, Department of Agada Tantra, Sri Dharmasthala Manjunateshwara College of Ayurveda and Hospital, Hassan. DOI: <https://doi.org/10.5281/zenodo.18874374>**How to cite this Article:** Akarsha Krishna S.<sup>\*1</sup>, Ashwin Kumar S. Bharati<sup>2</sup> (2026). Evaluation Of Hair Growth Promoting Potential Of Durdhuradi Taila Through Modulation Of 5 $\alpha$ -Reductase Gene Expression. World Journal of Pharmaceutical and Medical Research, 12(3), 479–482.

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**ABSTRACT**

**Introduction:** Hair plays a significant role in physical appearance, personal identity, cultural expression, and psychological well-being. Hair loss (alopecia) often results in embarrassment, reduced self-confidence, social withdrawal, and impaired quality of life. Beyond aesthetics, scalp hair provides protection against ultraviolet (UV) radiation, temperature extremes, and environmental irritants. Loss of hair increases scalp vulnerability to sunburn, sensitivity, and injury. **Methods:** Alopecia is defined as partial or complete loss of hair from normally hairy areas, most commonly the scalp. Major types include androgenic alopecia, alopecia areata, and chemotherapy-induced alopecia. Androgenic alopecia is the most prevalent, affecting nearly 50% of men and women, with higher incidence in men aged 30–50 years. In men, hair loss begins at the temples and vertex, while women show diffuse thinning over the crown.<sup>[1]</sup> **Results:** The condition is genetically determined and androgen-dependent. Testosterone is converted to dihydrotestosterone (DHT) by the enzyme 5 $\alpha$ -reductase. DHT shortens the hair growth cycle, causes follicular miniaturization, and results in progressive thinning and hair loss. Modern lifestyle factors such as chemical treatments, dyes, gels, and excessive styling further aggravate hair fall. **Discussion:** *Ayurvedic* texts like the *Sushruta Samhita* caution against toxic scalp applications. Traditional formulations such as *Durdhuradi Taila*, recommended for *kesha chyuti*, are believed to nourish the scalp, strengthen hair roots, and promote regrowth. Effective management of alopecia requires understanding its biological mechanisms, avoiding harmful hair practices, and adopting holistic therapeutic approaches for optimal scalp and hair health.<sup>[2]</sup>

**KEYWORDS:** Androgenic alopecia, *Durdhuradi Taila*, 5 $\alpha$ -reductase, Hair growth, In-vitro study.**INTRODUCTION**

Hair plays an important role in physical protection, social identity, and psychological well-being. Androgenic alopecia (AGA) is the most common cause of hair loss, affecting a large proportion of adults and often leading to emotional distress, reduced self-esteem, and impaired quality of life. It is a progressive, genetically determined condition characterized by patterned hair loss in both men and women, with increasing prevalence with age. The pathogenesis of AGA is closely linked to androgen metabolism, where testosterone is converted to dihydrotestosterone (DHT) by the enzyme 5 $\alpha$ -reductase. DHT binds strongly to androgen receptors in hair follicles, leading to follicular miniaturization, shortening of the anagen phase, and eventual hair loss.<sup>[3]</sup> Among the two isoforms, 5 $\alpha$ -reductase type II plays a major role.

Current treatments include topical minoxidil and oral finasteride<sup>[4]</sup>; however, finasteride is associated with adverse effects, necessitating safer alternatives. In *Ayurveda*, hair loss is described as *Khalitya*, and medicated oils such as *Durdhuradi Taila* are traditionally used. This study aims to evaluate the effect of *Durdhuradi Taila* on 5 $\alpha$ -reductase gene expression using an in-vitro model.

**MATERIALS AND METHODS****Study Design**

An experimental in-vitro study was conducted to evaluate cytotoxicity and gene expression changes following treatment with *Durdhuradi Taila*.

**Test Drug**

*Durdhuradi Taila* was prepared according to classical *Ayurvedic* textual references using authenticated raw materials. The formulation underwent standard *Shodhana* and quality assessment prior to experimental use.

**Cell Line**

Human keratinocyte cell line (HaCaT) was used as the experimental model due to its relevance in hair follicle biology and scalp physiology.

**Cytotoxicity Assay (MTT Assay)**

The MTT assay was employed to assess cell viability and determine non-toxic concentrations of *Durdhuradi Taila*. HaCaT cells were cultured and treated with graded concentrations of the *Durdhuradi Taila*. Cell viability was expressed as percentage survival compared to untreated controls.

**Gene Expression Analysis**

Total RNA was isolated from treated and control cells using standard extraction protocols. Complementary DNA (cDNA) synthesis was performed, followed by

quantitative real-time PCR to assess the expression of the  $5\alpha$ -reductase gene. Gene-specific primers were used, and expression levels were normalized to housekeeping genes.

**Statistical Analysis**

All data were presented as mean  $\pm$  standard deviation. A *t*-test was used for multiple post-hoc comparisons. Quantification of the RT-PCR results was performed by plotting fluorescent signal intensities against the number of PCR cycles on a semi-logarithmic scale. The threshold cycle (CT) was designated as the amplification cycle at which the first significant increase in fluorescence occurred. The relative gene expression of target genes, in comparison to the reference gene GAPDH, was calculated using the  $2^{-\Delta\Delta CT}$  method.

**RESULTS****Cytotoxicity Assessment**

*Durdhuradi Taila* exhibited acceptable cell viability across tested concentrations. Non-toxic doses suitable for gene expression analysis were identified, confirming the safety of the formulation in the in-vitro model.

**Table 1: In vitro cytotoxicity of *Durdhuradi taila* in terms of percentage cell toxicity against Human keratinocytes (HaCaT) cell line by MTT assay.**

Concentration ( $\mu\text{g/mL}$ )	Percentage of cell toxicity (Mean $\pm$ SD)	Percentage of cell viability (Mean $\pm$ SD)
1000	24.44 $\pm$ 4.32	75.56 $\pm$ 4.32
500	23.27 $\pm$ 3.02	76.73 $\pm$ 3.02
250	20.06 $\pm$ 3.27	79.94 $\pm$ 3.27
125	19.20 $\pm$ 0.93	80.80 $\pm$ 0.93
62.5	14.69 $\pm$ 1.36	85.31 $\pm$ 1.36
31.25	11.85 $\pm$ 1.11	88.15 $\pm$ 1.11
15.625	7.72 $\pm$ 1.30	92.28 $\pm$ 1.30
7.8	1.79 $\pm$ 0.68	98.21 $\pm$ 0.68

 **$5\alpha$ -Reductase Gene Expression**

Treatment with *Durdhuradi Taila* resulted in a significant reduction in  $5\alpha$ -reductase gene expression compared to untreated control cells. The degree of downregulation

was comparable to that observed with standard reference compounds, indicating a potential inhibitory effect on androgen metabolism at the molecular level.

**Table 2: The quantitative expression level of  $5\alpha$  - reductase gene in *Durdhuradi taila* treated cells.**

Test Substance	Concentration ( $\mu\text{g/mL}$ )	Gene Expression Folds
		$5\alpha$ -Reductase
Cell Control	-	1.36 $\pm$ 0.16
Standard- Proscar	250	0.80 $\pm$ 0.20
<i>Durdhuradi Taila</i>	500	0.76 $\pm$ 0.07
<i>Durdhuradi Taila</i>	250	0.91 $\pm$ 0.07

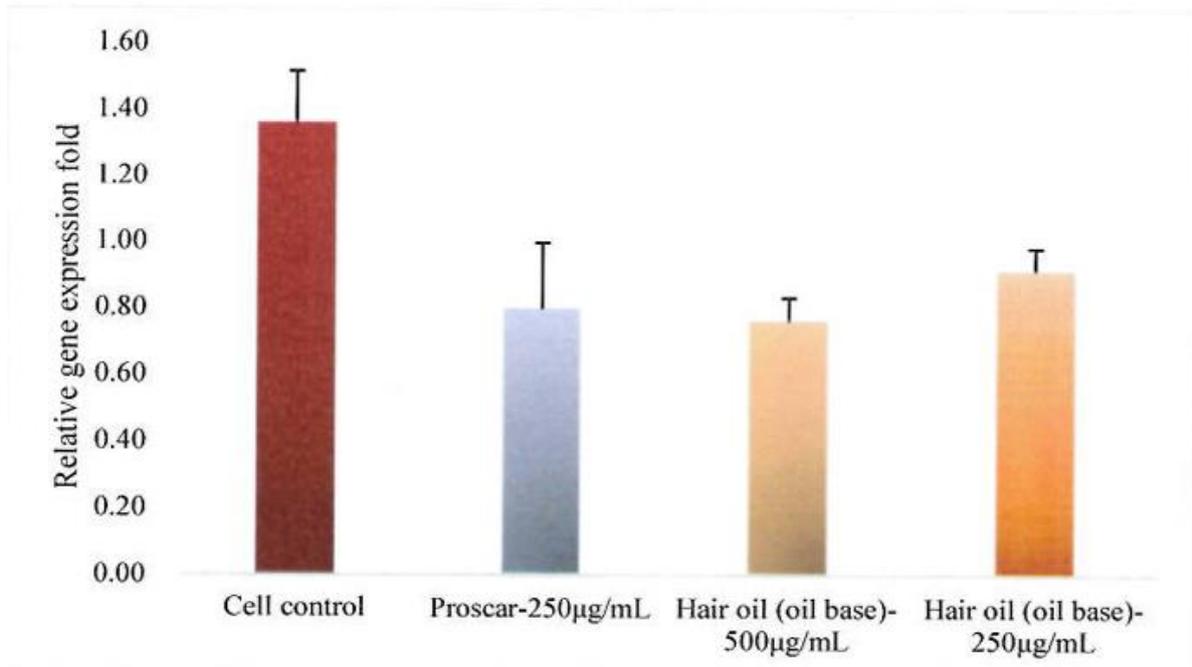


Fig 1: Relative gene expression of 5 $\alpha$ -reductase in *Durdhuradi taila* and standard treated cells.

#### ANNEXURE



Fig 2: sample addition.



Fig 4: Tissue culture.



inhibition of 5 $\alpha$ -reductase activity and protection of follicular cells from oxidative stress.

Compared to synthetic 5 $\alpha$ -reductase inhibitors, herbal formulations such as *Durdhuradi Taila* may offer a better and safer therapeutic profile with reduced risk of systemic adverse effects. However, further studies, including in-vivo models and clinical trials, are required to confirm efficacy, safety, and optimal dosage.

## CONCLUSION

*Durdhuradi Taila* demonstrated significant anti-hair fall activity in an in-vitro model through effective inhibition of 5 $\alpha$ -reductase gene expression, leading to reduced DHT levels. The formulation exhibited minimal cytotoxicity on HaCaT cells, indicating a favourable safety profile. Higher concentrations, particularly 1000  $\mu$ g/mL, showed optimal efficacy with acceptable cell viability. Notably, *Durdhuradi Taila* produced superior inhibitory effects compared to the standard control at 500  $\mu$ g/mL. These findings confirm its dose-dependent biological activity. The results provide scientific evidence supporting its traditional *Ayurvedic* use in *Khalitya*. Overall, *Durdhuradi Taila* demonstrates as a potential natural therapeutic option for the treatment of Androgenetic Alopecia.

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