

Effect of *Tamarindus indica* and its Polyherbal Formulation on Radiation induced Alopecia

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Abstract: Radiation-induced skin changes and associated hair loss are severe complications of radiotherapy. The damage is caused by a photon, electron, proton, neutron, or ion beam directly or indirectly ionizing the atoms which make up the DNA chain. Indirect ionization happens as a result of the ionization of water, forming free radicals, notably hydroxyl radicals, which then damage the DNA. The present study is to evaluate the effect of *Tamarindus indica* and its polyherbal formulation on radiation induced alopecia.

Keywords: Alopecia, *Tamarindus Indica*, *Curcuma longa*.

Introduction

Radiation-induced skin changes and associated hair loss are severe complications of radiotherapy. Unfortunately, in order to achieve a curative dose to the tumor, some degree of radiation damage in surrounding tissues is generally acceptable. Hair loss due to radiation may be most pronounced in patients who have received radiotherapy to the brain. Unlike the hair loss seen with chemotherapy, radiation-induced hair loss is more likely to be permanent, but is also more likely to be limited to the area treated by the radiation¹. Therefore there is need for the development of a formulation having ability to prevent radiation induced hair loss.

The plants under study are *Tamarindus indica* and *Curcuma longa*. Ethaolic extract of seed coat of *T. indica* and ethanolic extract of rhizomes of *C. longa* are used.

Materials and Methods

14 weeks old mice weighting 150–200 g were used. All mice were housed in a specific pathogen-free

environment in a temperature-controlled room (21°C, relative humidity 50%–70%) with a 12-hrs light–dark

cycle and were fed standard food and water *ad libitum* until evaluation.^{1,2}

Preparation of formulation

Tamarindus indica and *Curcuma longa* were extracted by using ethanol by soxhlet extraction method. Suspension (2%) was prepared with tragacanth mucilage. While water soluble ointment base containing PEG 4000 and PEG 6000 was used to prepare 5% ointment. Polyherbal formulation contains both the drug in 1:1 ratio.

Grouping of animals

Group I : (Control) receives no treatment.

Group II : (Negative control) receives radiation without any test drug treatment.

Group III : receives radiation with *T. indica* (300mg/kg) oral treatment as well as topical (5% ointment) treatment.

Group IV : receives radiation with polyherbal formulation (300mg/kg) oral treatment as well as topical (5% ointment) treatment.

Application of radiation

On experiment day 1 mice were irradiated. Before irradiation, Group II did not receive any drug, whereas Group III and IV received *T. indica* and polyherbal formulation oral treatment as well as topical treatment respectively. Irradiation was delivered by a Theratron ⁶⁰Co teletherapy unit. Mice were received whole body radiation with a depth of 2 cm with a single 8 Gy fraction dose for 10 minutes.^{3,4,5,6}

Group III and IV receives continues treatment of test drugs *T. indica* and polyherbal extract oral as well as topical treatment respectively for next 29 days. On experiment day 16th, 25th and 30th day blood samples were collected and haematological studies were done. On 30th day of the experiment mice skin specimen from all groups were collected for histopathological analysis.¹

Result and Discussion

Radiation may cause a generalized lymphocyte-mediated hypersensitivity reaction. because of which the lymphocyte count of negative control rises by 25.16 % while that of *T. indica* was 16.66 % the lymphocyte count in poly herbal found to be decreased by 17.00 % in comparison to negative control 25.16 %, decrease in lymphocyte count shows

reduction in lymphocyte-mediated hypersensitivity reaction (Table 1).

The hair density of the control group in 1mm² was 19.50 and that of negative control were 12.66 this might have happen due to changes brought by radiation in dermal papilla specifically affects keratinocytes which are highly sensitive to radiation. The hair density was found be significantly improved in polyherbal 17.83 mm² in comparison with toxic group, the *T. indica* also increases the hair density significantly by 15.66 mm² but low in comparison to polyherbal. (Table 1).

The result of histopathological analysis shows that in control group maximum hair follicles (HFs) were in anagen phase of hair cycle while that in negative control group were in telogen phase which may be due to radiation effect on hair follicle cycling. Keratinocytes, a rapidly proliferating cell system would be expected to be very sensitive to radiation exposure. The damage of the proliferative cells in hair follicle matrix caused by irradiation reflected as reduced cell output of the hair and cells continue forming hair after irradiation at a reduced rate, resulting with production of histopathologically abnormal or dysplastic hair. The number of hair follicles in toxic group was less in comparison to control. While in *T. indica* and polyherbal maximum of HFs were in anagen phase of hair cycle. The percentage population of hairs in different phases of hair cycle was given in Table 1.

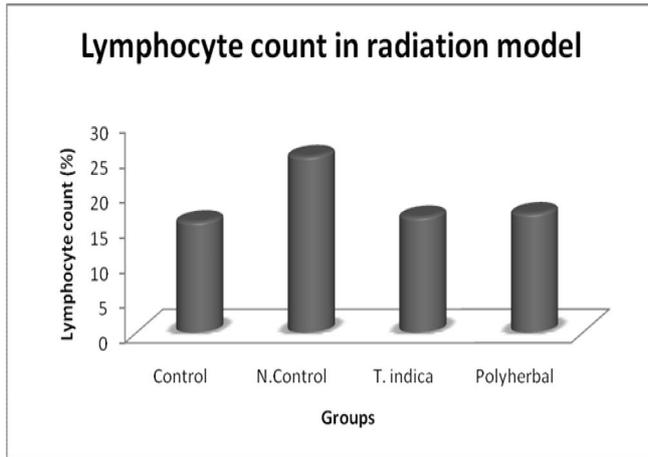
Table 1 Effect of ethanolic extract of *T. indica* and polyherbal formulation on parameters

| S.No. | Treatment | Lymphocyte count (%) | Hair density (mm ²) |
|-------|------------------|----------------------|---------------------------------|
| 1 | Control | 15.83±0.75 | 19.16±0.75 |
| 2 | Negative control | 25.16±1.04 | 12.83±1.32 |
| 3 | <i>T. indica</i> | 16.50±1.37 | 15.66±0.81 |
| 4 | Polyherbal | 17.00±0.89 | 17.83±0.75 |

All the values were expressed as mean ± standard deviation (S.D.). The difference was considered significant when *P*-values < 0.01.

Table 2 Percentage population of hairs in radiation model

| S.No. | Groups | Anagen | Catagen | Telogen |
|-------|------------------|--------|---------|---------|
| 1. | Control | 65 | 3 | 32 |
| 2. | Negative Control | 45 | 3 | 52 |
| 3. | <i>T. indica</i> | 55 | 2.5 | 42.5 |
| 4. | Polyherbal | 62 | 2.5 | 35.5 |



Graph 1 Lymphocyte count in radiation model

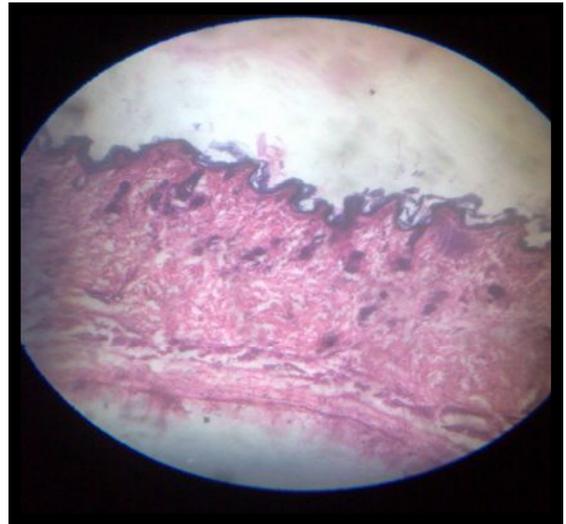
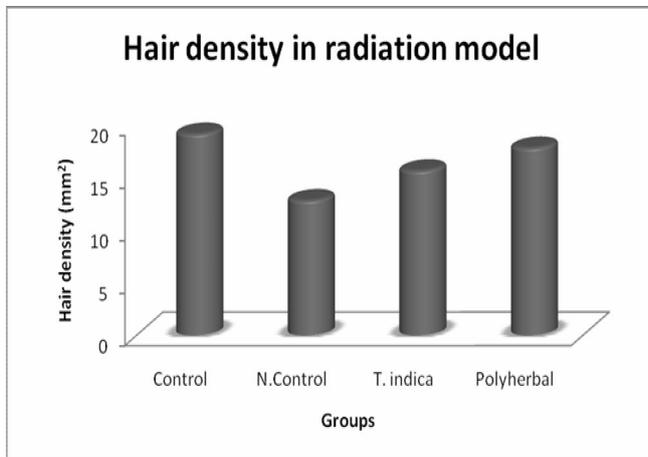


Fig 2 Histopathology of negative control group



Graph 2 Hair density in radiation model

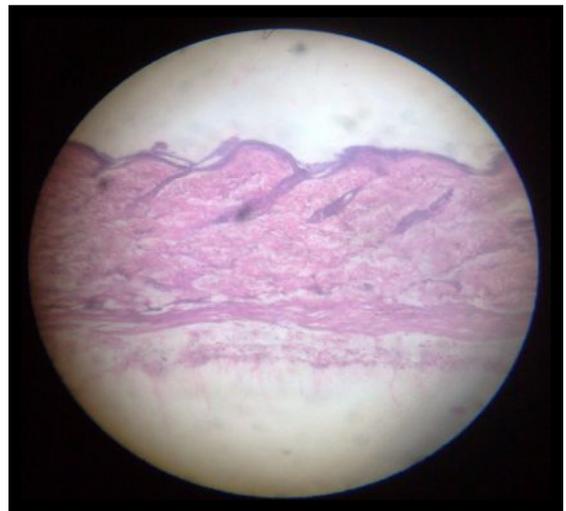


Fig 3 Histopathology of *T. indica* group

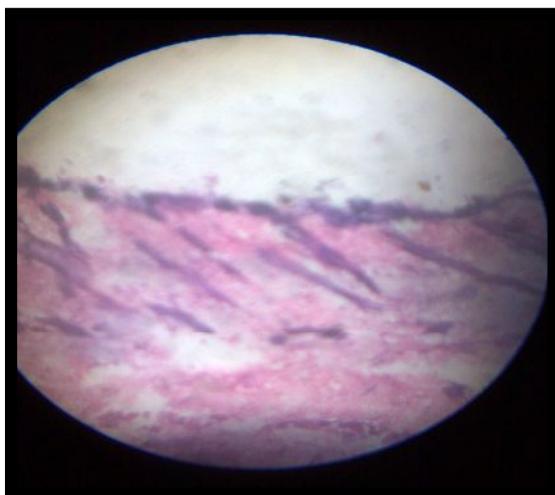


Fig 1 Histopathology of control group



Fig 4 Histopathology of polyherbal group 2

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