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EFFECT OF ANTINEOPLASTIC LOADED TRANSDERMAL PATCH IN DMBA-INDUCED BREAST CANCER

Chandra Shekhar Sharma *, Prashant Kumar and Anurag Verma

Department of Pharmaceutics, Teerthanker Mahaveer College of Pharmacy, Teerthanker Mahaveer University, Moradabad - 244101, Uttar Pradesh, India.

Keywords:

Antineoplastic, Nanoformulation, Tamoxifen, Transdermal patch

Correspondence to Author:
Chandra Shekhar Sharma

Ph.D. Scholar,
Department of Pharmaceutics,
Teerthanker Mahaveer College of Pharmacy, Teerthanker Mahaveer University, Moradabad - 244101,
Uttar Pradesh, India.

E-mail: sharma.chandrashekhar16@gmail.com

ABSTRACT: Background: The current study assessed the effect of an Antineoplastic-loaded transdermal patch in Dimethyl-benzanthracene (DMBA)-induced breast cancer. **Materials and Methods:** Different formulations composed of various concentrations of tamoxifen citrate, poly (SA: RA), glucose, and mannitol were formulated and evaluated in DMBA-induced breast cancer in female albino Wistar rats. Multiple parameters were evaluated, such as body weight, hemoglobin content, red blood cell, white blood cell, SGPT, and SGOT. **Results:** Treatment with formulations showed a decrease in body weight compared to disease. Equally, a considerable increase in hemoglobin was observed in the formulation-treated group over the disease grouping. Likewise, there is a decrease in SGPT and SGOT in formulation compared to disease. **Conclusion:** The present study revealed a transdermal patch loaded with tamoxifen showed promising antitumor activity.

INTRODUCTION: Tamoxifen is used for preventative care in premenopausal and postmenopausal female patients with cancer [1]. It is a non-steroidal triphenylethylene derivative that competes with steroids for the steroid receptors in cancer cells. However, this medication has several negative effects, including blood problems, viscous sphacelus, hepatotoxicity, multifocal viscous and fatty infiltration [2, 3]. Transdermal patches with tamoxifen-loaded formulations would have decreased hepatotoxicity and greater patient adherence to therapy for hemolytic carcinoma.

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This approach is crucial for increasing the pharmacokinetic profile, improving effectiveness, and reducing toxicity [4], which may result from the ability of small particles to cross biological barriers [5, 6]. Nanoparticles can be used as a controlled release method in the treatment of cancer and can lessen the explosion of several adverse effects. Because of this, the current study looked at how well a transdermal patch filled with tamoxifen protected against breast cancer. Various amounts of medication (tamoxifen), a polymer (SA: RA), and a cryoprotectant (glucose and mannitol) made up the formulations. **Table 1** provides a summary of the specifics of several formulations.

MATERIALS AND METHODS:

Evaluation of *In-vivo* Antitumor Property: The investigation was conducted after completing the OECD 423 [7] acute toxicity test. 25 mg of DMBA was dissolved in 1 ml of a vehicle before being

administered subcutaneously. After the trial was over, the tumour yield was assessed. There were seven separate groups, each with 12 female albino rats. Each group comprised 12 female albino rats.

Group 1: The normal control.

Group 2: The cancer group negative control.

Group 3: The tamoxifen group positive control (PC).

Group 4: F1.
Group 5: F2.
Group 6: F3.
Group 7: F4.

TABLE 1: COMPOSITION OF FORMULATIONS

Formulation	Drug	Polymer	Cryoprotectant	
	Tamoxifen Poly Citrate (mg)	(SA: RA) 7:3 (mg)	Glucose(mg)	Mannitol(mg)
F1	10	190	14	14
F2	20	180	14	14
F3	40	160	14	14
F4	60	140	14	14

Test Sample Treatment: Tamoxifen was intravenously administered for PC. A vehicle was introduced into the control group. Similar treatments were administered to Groups 4, 5, 6 and 7, and the trial lasted 30 days. Numerous physical and biochemical indicators were assessed at the conclusion of the research.

Parameters Evaluated: After the trial, body weight was assessed for each group and compared in order to assess the contribution of formulation to the management of tumours. Similarly, peripheral blood was also evaluated for haematological parameters such as haemoglobin, white blood cell (WBC), and red blood cell (RBC) counts. Additionally, serum levels of glutamic-pyruvic transaminase (SGPT) and glutamic-oxaloacetic transaminase (SGOT) were measured using commercially available kits. The institutional ethics committee granted its consent for institutional ethics.

RESULTS:

Effect on Final Body Weight: The disease group's body weight increased significantly compared to a normal group. Comparatively to the cancer group, there was also a sizable drop in body weight in the PC group. The body weight of formulation F1 was also much lower than that of the cancer group. The body weight of formulation F2 was much lower than that of the cancer group. Furthermore, the F3 group had a significant drop compared to the cancer group. Similar to the cancer group, the F4 group had a significant decline. **Fig. 1.**

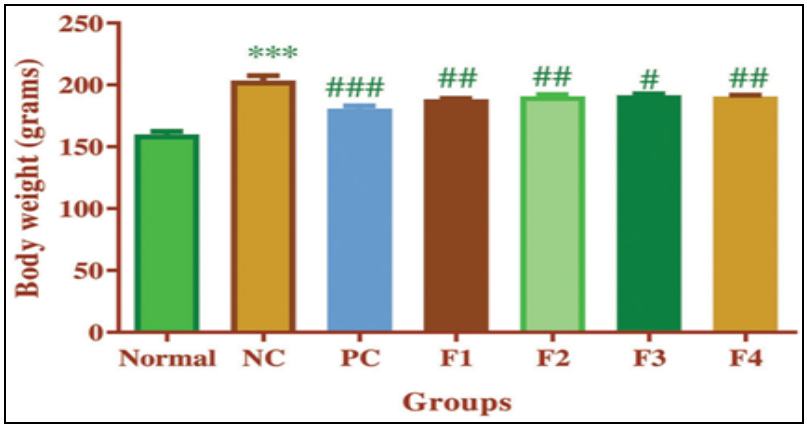

FIG. 1: EFFECT OF MULTIPLE FORMULATION IN BODY ***P<COMPARED TO NORMAL CONTROL, #P<0.05, ###P<0.001 COMPARED TO CANCER GROUP

Effect on Hemoglobin Content: When compared to the healthy control group, the illness group's haemoglobin content was shown to be significantly lower. The PC's haemoglobin content also increased significantly as compared to the illness group. Like the normal illness group, formulations F1, F3 and F4 also showed a significant rise in haemoglobin content. Contrary to the disease group, formulation F2 did not affect hemoglobin content **Fig. 2.**

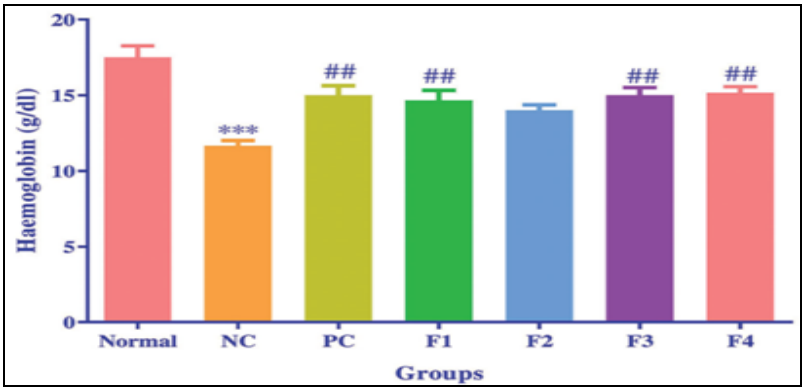

FIG. 2: EFFECT OF FORMULATIONS ON HEMOGLOBIN CONTENT (GM/DL) ***P<0.001 COMPARED TO NORMAL GROUP, ##P<0.01 COMPARED TO DISEASE CONTROL GROUP

Effect on Red Blood Cell Count: When compared to a normal group, the RBC count was much lower in the illness group, while it was higher in the PC group. RBC count increased during formulation treatments. However, the outcomes weren't really significant **Fig. 3.**

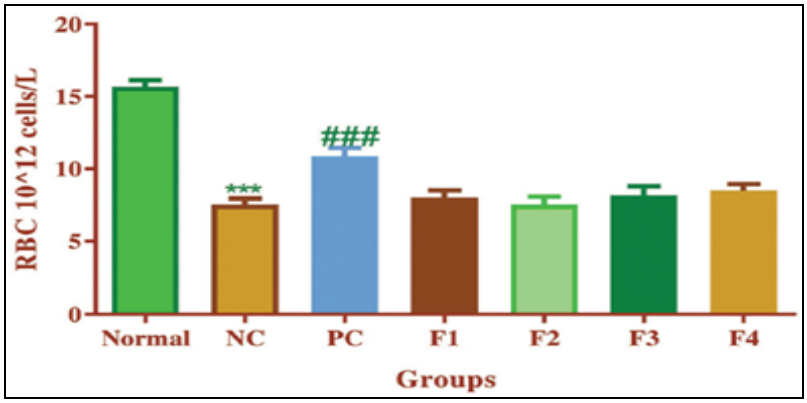

FIG. 3: EFFECT OF FORMULATIONS IN RED BLOOD CELL ***P<0.001 COMPARED TO NORMAL ###P<0.001 COMPARED TO DISEASE GROUP

Effect on White Blood Cell Count: The illness group's WBC count was significantly lower compared to the normal group. Similar to how the WBC count significantly increased in the PC group compared to the illness group. The WBC count increased in the formulation-treated groups, but the outcomes were not significantly different from the disease control group **Fig. 4.**

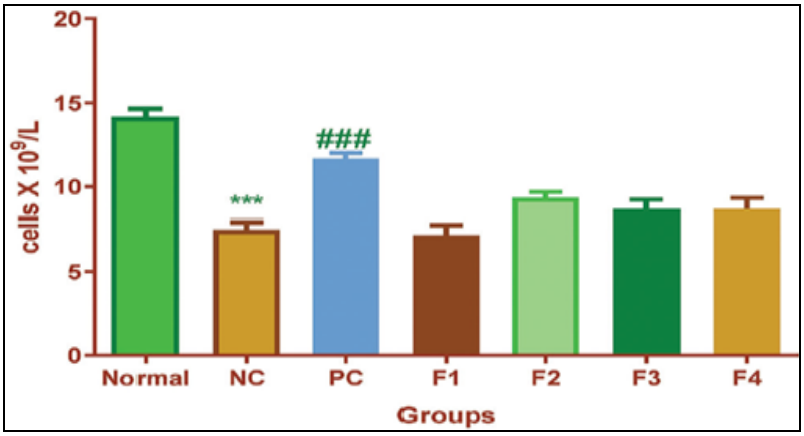

FIG. 4: EFFECT OF FORMULATIONS IN WHITE BLOOD CELL ***P<0.001 COMPARED TO NORMAL ###P<0.001 COMPARED TO DISEASE GROUP

Effect on Tumor Weight: Compared to the illness group, the PC group's tumour weight significantly decreased. Similar results were seen when using formulations F1 and F2, which both demonstrated a

significant reduction in tumour weight compared to disease control. Similar to formulation F2, the illness group's tumour weight significantly decreased compared to formulation F3. In contrast to the illness group, formulation F4 showed no effect on tumour weight reduction **Fig. 5.**

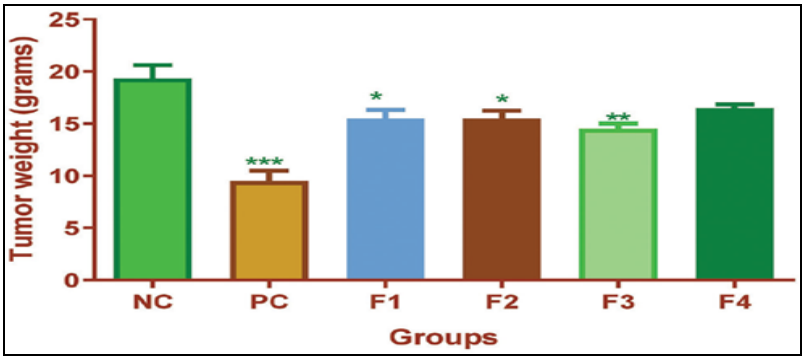

FIG. 5: EFFECT OF FORMULATIONS IN TUMOR WEIGHT *P<0.005<*P<0.001 COMPARED TO DISEASE GROUP**

Effect on SGPT: In comparison to the normal group, the illness group's SGPT level was shown to be significantly higher. The SGPT level did, however, significant decline in the tamoxifen and formulation (F1-F4) treated groups. In addition, the SGPT level in formulations was lower compared to the tamoxifen group **Fig. 6.**

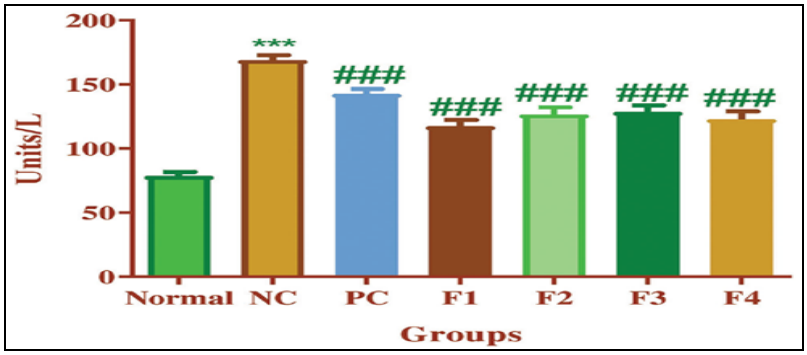

FIG. 6: EFFECT OF SGPT LEVELS ***P<0.001 COMPARED TO NORMAL GROUP, ###P<0.001 COMPARED TO DISEASE GROUP

Effect on SGOT Level: The illness group's SGOT level was shown to be substantially higher than usual. However, the SGOT level showed a significant decline in the tamoxifen and formulation (F1-F4) treated groups. In addition, the SGOT level in formulations was lower compared to the tamoxifen group **Fig. 7.**

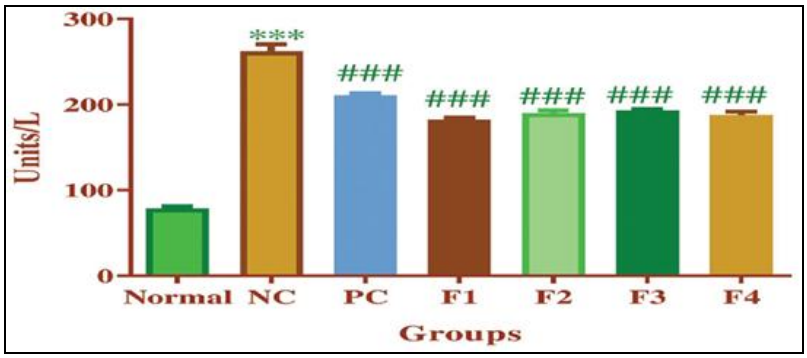

FIG. 7: EFFECT OF SGOT LEVELS ***P<0.001 COMPARED TO NORMAL GROUP, ###P<0.001 COMPARED TO DISEASE GROUP

DISCUSSION: We examined four distinct formulations in the current study and evaluated them for several factors, including body weight, tumour weight, RBC, WBC and haemoglobin

content. All of the outcomes were contrasted with the tamoxifen gold standard of care. Nanoformulations in the pharmacotherapy of several illnesses, including breast cancer, is widely acknowledged. [8] Additionally, a polygenic risk exists for the aetiology of breast cancer [9].

Since treating such polygenic disorders is straightforward and the medicine is released quickly using this method, it is more practical. The current investigation also showed that F1, F2 and F3 formulations reduced tumour weight. Similarly, the formulation-treated group's body weight dropped. This indicates that the formations have the ability to release the drug at the desired location. Additionally, cancer is a polygenic disease [10]. Despite the fact that we are focusing on a particular molecule or protein, pharmacotherapy for this ailment may be challenging. However, a single substance has the ability to control several proteins and pathways [11].

Even though the tamoxifen-loaded formulation was examined in the current investigation, there is always a chance that it might affect a number of proteins and pathways, as previously predicted [12–15]. This possibility must still be considered for tamoxifen-loaded formulations. The formulation used in the current investigation indicated what previous research [16] implies is a reduction in haemoglobin during cancer aetiology. RBC and WBC levels also rose; however, they were not significantly higher than the illness group. This demonstrates that sympathomimetic relief has not been attained in the shorter period that may have been attained following long-term therapy, which is the focus of future research. Increased SGOT and SGPT levels, which suggest hepatotoxicity [17] and need to be reduced, are one of the main drawbacks in cancer pharmacotherapy. After receiving tamoxifen medication, the levels of SGOT and SGPT decreased in our research. Additionally, SGOT and SGPT levels in our formulation were lower than those in the tamoxifen group, which may be due to focused drug administration.

CONCLUSION: The current study demonstrated the anticancer activity of different formulations and their efficacy in a wide range of biochemical and hematological parameters, emphasizing the importance of nanoparticles in cancer pharmacotherapy and targeted drug delivery systems.

Ethical Statement: IAEC Approval number: 1205/PO/RE/S/08/CPCSEA (21/04/2008).

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CONFLICTS OF INTEREST: Nil

REFERENCES:

1. Heery M, Corbett P and Zelkowitz R: Precautions for patients taking tamoxifen. J Adv Pract Oncol 2018; 9: 7883.
2. Maximov PY, Lee TM and Jordan VC: The discovery and development of selective estrogen receptor modulators (SERMs) for clinical practice. Curr Clin Pharmacol 2013; 8: 13555.
3. Yang G, Nowsheen S, Aziz K and Georgakilas AG: Toxicity and adverse effects of tamoxifen and other antiestrogen drugs. Pharmacol Ther 2013; 139: 392404.
4. Gunasekaran T, Haile T, Nigusse T and Dhanaraju MD: Nanotechnology: An effective tool for enhancing bioavailability and bioactivity of phytomedicine. Asian Pac J Trop Biomed 2014; 4: 17.
5. Zhang XQ, Xu X, Bertrand N, Pridgen E, Swami A and Farokhzad OC: Interactions of nanomaterials and biological systems: Implications to personalized nanomedicine. Adv Drug Deliv Rev 2012; 64: 136384.
6. De Jong WH and Borm PJ: Drug delivery and nanoparticles: applications and hazards. Int J Nanomedicine 2008; 3: 13349.
7. OECD Guideline for Testing of Chemicals. Acute Oral Toxicity Acute Toxic Class Method. Available 18 June 2019.
8. Yezhelyev MV, Gao X, Xing Y, AlHajj A, Nie S and O'Regan RM: Emerging use of nanoparticles in diagnosis and treatment of breast cancer. Lancet Oncol 2006; 7: 65767.
9. Mina LA and Arun B: Polygenic risk scores in breast cancer. Curr Breast Cancer Rep 2019; 11: 117.
10. Bredberg A: Cancer: More of polygenic disease and less of multiple mutations? A quantitative view point. Cancer 2011; 117: 440-5.
11. Khanal P, Patil BM, Mandar BK, Dey YN, Duyu T. Network pharmacology based assessment to elucidate the molecular mechanism of anti-diabetic action of *Tinospora cordifolia*. Clin Phytosci 2019; 5: 35.
12. Khanal P and Patil BM: Gene set enrichment analysis of alpha glucosidase inhibitors from *Ficus benghalensis*. Asian Pac J Trop Biomed 2019; 926370.
13. Khanal P, Mandar BK, Patil BM Ficusbenghalensis Hullatti KK: *In-silico* antidiabetic screening of Borapetoside C, Cordifolioside A and Magnoflorine. Indian J Pharm Sci 2019; 81: 5505.
14. Khanal P, Mandar BK, Magadum P, Patil BM and Hullatti KK: *Ficus benghalensis in-silico* docking study of limonoids from *Azadirachta indica* with pfpk5: A novel target for *Plasmodium falciparum*. Indian J PharmS ci 2019; 81: 32632.
15. Patil VS, Biradar PR, Attar V Ficusbenghalensis Khanal P: *In-silico* docking analysis of active biomolecules from *Cissus quadrangularis* L. Indian J Pharm Educ 2019; 53: 3327.

16. Dicato M, Plawny L Cissusquadrangularis Diederich M: Anemia in cancer. Ann Oncol 2010; 21(7): 16772.
17. Singh TD, Barbhuiya MA, Poojary S, Shrivastav BR Cissusquadrangularis Tiwari PK: The liver function test enzymes and glucose level are positively correlated in gallbladder cancer: A cancer registry data analysisfrom North central India. Indian J Cancer 2012; 49: 12536.

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