

**EKSPRESI RELATIF mRNA *TNF- $\alpha$* , *TGF- $\beta$* , DAN *IL-10* LIMPA TIKUS  
(*Rattus norvegicus* Berkenhout, 1769) DENGAN DAN TANPA TUMOR  
PAYUDARA SETELAH PAPARAN MEDAN LISTRIK STATIS  
FREKUENSI MENENGAH**

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**INTISARI**

*Electro Capacitive Cancer Therapy* (ECCT) merupakan alat terapi kanker berbasis paparan medan listrik statis sebagai alternatif terapi kanker payudara. Alat yang telah diuji secara praklinis terkait efektivitasnya terhadap penghambatan tumor payudara. Perlakuan paparan medan listrik intensitas rendah (18 Vpp) frekuensi menengah (150 kHz) *in vivo* dapat menghambat proliferasi sel kanker payudara. Terapi tersebut dipaparkan pada tubuh hewan model, sehingga dapat berpengaruh ke organ vital. Penelitian ini bertujuan untuk mempelajari keamanan dari terapi paparan medan listrik statis terhadap organ vital khususnya limpa melalui ekspresi gen terkait respon inflamasi yaitu *TNF- $\alpha$* , *TGF- $\beta$*  dan *IL-10*. Sampel koleksi berasal dari penelitian sebelumnya (2018) menggunakan tikus (*Rattus norvegicus* Berkenhout, 1769) galur Sprague Dawley yang telah dibagi dalam 4 kelompok: Non Induksi-Non Terapi (NINT) sebagai kontrol, Non Induksi-Terapi (NIT) sebagai placebo, Induksi-Non Terapi (INT) dan Induksi-Terapi (IT). Tikus diinduksi DMBA dan dipapar medan listrik statis frekuensi menengah (150 kHz) dan intensitas rendah (18 Vpp). Total RNA diisolasi dari jaringan limpa, kemudian dilakukan sintesis cDNA dengan PCR. Selanjutnya, analisis ekspresi mRNA *TNF- $\alpha$* , *TGF- $\beta$*  dan *IL-10* dilakukan dengan metode qPCR. Analisis data dengan rumus Livak, aplikasi GraphPad Prism 9.0, dan uji signifikansi dengan ANOVA ( $\alpha = 0.05$ ). Hasil menunjukkan tidak ada pengaruh signifikan ( $p > 0,05$ ) terhadap ekspresi relatif mRNA pada gen *TNF- $\alpha$* , *TGF- $\beta$* , dan *IL-10* di limpa tikus. Terapi medan listrik statis tidak menyebabkan perubahan ekspresi mRNA relatif *TNF- $\alpha$* , *TGF- $\beta$*  dan *IL-10* pada organ limpa tikus tanpa dan dengan tumor payudara.

**Kata kunci:** mRNA, *TNF- $\alpha$* , *TGF- $\beta$* , *IL-10*, limpa tikus, medan listrik statis.

**mRNA RELATIVE EXPRESSION OF *TNF- $\alpha$* , *TGF- $\beta$* , AND *IL-10* IN  
SPLEEN OF RAT (*Rattus norvegicus* Berkenhout, 1769) WITH AND  
WITHOUT MAMMARY TUMOR AFTER EXPOSED TO MEDIUM  
FREQUENCY OF STATIC ELECTRIC FIELD**

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**ABSTRACT**

Electro Capacitive Cancer Therapy (ECCT) is a device for cancer therapy based on exposure to static electric fields as an alternative to breast cancer therapy. This device has been tested preclinically for its effectiveness against breast tumor inhibition. Treatment of low-intensity (18 Vpp) medium-frequency (150 kHz) electric field exposure in vivo can inhibit the proliferation of breast cancer cells. The therapy is exposed to the body of experimental animals so it can affect vital organs. This study aims to study the safety of static electric field exposure therapy to vital organs, especially the spleen through the expression of genes related to the inflammatory response: *TNF- $\alpha$* , *TGF- $\beta$*  and *IL-10*. The sample collection comes from a previous study (2018) using rats (*Rattus norvegicus* Berkenhout, 1769) Sprague Dawley) which have been divided into 4 groups; Non-Induction-Non-Therapeutic (NINT) as control, Non-Induction-Therapeutic (NIT) as placebo, Induction-Non-Therapeutic (INT) and Induction-Therapeutic (IT). The rats were induced by DMBA and exposed to a static electric field of medium frequency (150 kHz) and low intensity (18 Vpp). Total RNA was isolated from spleen tissue, then cDNA was synthesized by PCR. Furthermore, analysis of *TNF- $\alpha$* , *TGF- $\beta$*  and *IL-10* mRNA expression was performed by qPCR method. Data analysis using Livak formula, GraphPad Prism 9.0 application, and significance test using ANOVA ( $\alpha = 0.05$ ). Overall results showed no significant effect ( $p > 0.05$ ) to relative expression of mRNA in *TNF- $\alpha$* , *TGF- $\beta$*  and *IL-10* genes in rat's spleen. Static electric field therapy had no effect on the relative mRNA expression of *TNF- $\alpha$* , *TGF- $\beta$*  and *IL-10* in rat's spleen without and with mammary tumor.

**Keyword:** mRNA, *TNF- $\alpha$* , *TGF- $\beta$*  and *IL-10*, rat's spleen, electric field