

RELATIF EKSPRESI mRNA *TNF-Alpha*, *CCL2*, DAN *CCR2* JANTUNG TIKUS PUTIH [*Rattus norvegicus* (Berkenhout, 1769)] TANPA DAN DENGAN TUMOR PAYUDARA SETELAH PAPARAN MEDAN LISTRIK AC FREKUENSI MENENGAH

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INTISARI

Kanker merupakan masalah kesehatan yang menjadi pemicu kematian terbanyak di dunia, dengan kanker payudara menjadi salah satu jenis kanker terbanyak terdeteksi. Metode penyembuhan kanker yang telah ada dapat memberikan efek samping pada tubuh pasca pengobatan. Oleh karena itu, dikembangkan metode terapi kanker berbasis medan listrik, yaitu *Electro-Capacitive Cancer Therapy* (ECCT). Penelitian ini difokuskan pada ekspresi mRNA yang menjadi penanda karsinogenesis, antara lain *TNF-Alpha*, *CCL2*, dan *CCR2* pada organ vital non target berupa jantung. Penelitian ini bertujuan untuk mengetahui pengaruh terapi medan listrik *alternating current* (AC) dengan frekuensi menengah (150 kHz) dan voltase rendah (18 Vpp) terhadap ekspresi mRNA *TNF-Alpha*, *CCL2*, dan *CCR2*. Penelitian dilakukan pada jantung tikus tanpa dan dengan induksi DMBA serta tanpa dan dengan terapi ECCT. Kelompok penelitian dibagi menjadi empat perlakuan yaitu Non Induksi-Non Terapi (NINT), Induksi-Non Terapi (INT), Non Induksi-Terapi (NIT) serta Induksi-Terapi (IT). Penelitian dilakukan melalui proses qRT-PCR mRNA terkait untuk mengetahui perbedaan dan signifikansi nilai *fold change*. Hasil dianalisis menggunakan uji *one way* ANOVA menggunakan Biorad CFX managerTM dan *GraphPad Prism* 8.1. Hasil yang diperoleh menunjukkan tidak adanya perubahan ekspresi relatif mRNA *TNF-Alpha*, *CCL2*, dan *CCR2* secara signifikan ($p > 0,05$). Penelitian ini menunjukkan bahwa paparan medan listrik AC frekuensi menengah (150 kHz) dan voltase rendah (18 Vpp) tidak memberikan pengaruh terhadap ekspresi mRNA *TNF-Alpha*, *CCL2*, dan *CCR2* pada jaringan jantung tikus tanpa dan dengan tumor payudara.

Kata kunci: ECCT, *CCL2*, *CCR2*, jantung, *TNF-Alpha*, tumor payudara

RELATIVE mRNA OF *TNF-Alpha*, *CCL2*, AND *CCR2* EXPRESSION IN ALBINO RAT'S [*Rattus norvegicus* (Berkenhout, 1769)] HEART WITH AND WITHOUT MAMMARY TUMOR EXPOSED TO MEDIUM FREQUENCY AC ELECTRICAL FIELDS

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ABSTRACT

Cancer is a health problem that causes the most deaths in the world, breast cancer being one of the most detected types of cancer. Currently cancer healing methods can have side effects on the body after treatment. Therefore, an electric field-based cancer treatment was developed, namely Electro-Capacitive Cancer Therapy (ECCT). The research focused on the expression of mRNAs which are markers of carcinogenesis, including *TNF-Alpha*, *CCL2*, and *CCR2* in non-target vital organs, such as the heart. This study aims to determine the effect of alternating current (AC) electric field therapy with medium frequency (150 kHz) and low voltage (18 Vpp) on the expression of *TNF-Alpha*, *CCL2*, and *CCR2* mRNA. The study was conducted on albino rat's heart with and without DMBA induction also with and without ECCT therapy. The research group was divided into four treatments, that are Non Induction-Non Therapy (NINT), Induction-Non Therapy (INT), Non Induction-Therapy (NIT) and Induction-Therapy (IT). This study was carried out through the qRT-PCR process of related mRNA to find out the differences and the significance of fold changes. The results were analyzed using one-way ANOVA test Biorad CFX managerTM and GraphPad Prism 8.1. There were no significant changes in the relative expression of *TNF-Alpha*, *CCL2*, and *CCR2* mRNA ($p > 0.05$). This study revealed exposure to medium-frequency (150 kHz) and low-voltage (18 Vpp) AC electric fields has no effect on the expression of *TNF-Alpha*, *CCL2*, and *CCR2* mRNA in the heart tissue of rats with and without breast tumors. The results showed no significant changes in the relative expression of mRNA of *TNF-Alpha*, *CCL2*, and *CCR2* ($p > 0,05$). This study revealed medium frequency (150 kHz) with low voltage (18 Vpp) AC electric field exposure did not affect the expression of *TNF-Alpha*, *CCL2*, and *CCR2* in the cardiac tissue of rats with and without breast tumors.

Key word: breast cancer, *CCL2*, *CCR2*, ECCT, heart, *TNF-Alpha*