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From: rochmah kurnijasanti <rochmah-k@fkh.unair.ac.id> (Jun 5, 2020, 9:00 PM)

Dear Editor,

My name is Rochmah Kurnijasanti, Sub-Department of Pharmacology, Department of Veterinary Basic Medicine, Faculty of Veterinary Medicine, Universitas Airlangga, Indonesia.

I would like to submit my research article to Research Journal Pharmacy and Technology: RJPT, Entitled: "Cytotoxic Effect of *Capsicum annum* L. Extract on T47D cells: *In vitro* Study"

Please kindly check the attachment file. I look forward to hearing of you soon.

Thank You

Best Regards,  
Dr. Rochmah Kurnijasanti, drh., MSi.

Attachment: Kurnijasanti and Fadholly, 2020 - Capsicum annum (RJPT).doc (683 KB)

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From: editor.rjpt@gmail.com (Jun 6, 2020, 2:02 PM)

Dear Author,

Thanks for submission of paper. The manuscript no. of submitted paper is RJPT-9759/05-06-2020. The status of paper shall be communicated as soon as possible.

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To Rochmah Kurnijasanti  
 Your manuscript is interesting but I need you to answer some questions:

1. Abstract: There is no mention of the Method in the abstract.
2. Introduction: You need to increase the prevalence of cancer cases; The research is aimed at proving Cytotoxic Effect of *Capsicum annum* L. extract. The authors should correct this.
3. Materials and Methods: Experimental Designs: The authors must specify the research design. It is not specified what kind of experimental study the authors have carried out; Statistical Analysis: Only one ANOVA has been performed? . Ethical considerations: Have you consulted the ethics committee? The authors must mention and say the reference.
4. Discussion: The authors have not explained how to apply the research to clinical practice.
5. References: Some references are incomplete or have errors. The authors should review this section.

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Paper Revision to RJPT

rochmah kurnijasanti <rochmah-k@fkh.unair.ac.id> to editor.rjpt

Jul 26, 2020, 7:07 PM

Dear Editor,

As requested, we have provided a point-by-point response to each of the reviewers' comments with relevant changes made to the manuscript. The results of revisions to the manuscript are indicated by sentences in yellow. Author Response in manuscript

1. Abstract: We have improved the method in the abstract
2. Introduction: We have added to the prevalence of cancer cases; We have changed the research objectives according to the reviewer's suggestion
3. Material and Methods: We have described the experimental design. We have improved the statistical analysis. We have added to the method a statement about procedures and ethical considerations
4. Discussion: We have described the application of research results to clinical practice; We have added the limitations of the study
5. Reference, we have corrected according to the RJPT writing guidelines

Thank you for considering our revised manuscript.

Sincerely  
 Rochmah Kurnijasanti

## **RESEARCH ARTICLE**

### **Cytotoxic Effect of *Capsicum annum* L. extract on T47D Cells: *In vitro* Study**

#### **ABSTRACT:**

*Capsicum annum* L. is a potential natural plant that have a lot of various pharmacological effects, including as anticancer agent. This study aim to analyze *Capsicum annum* extract (CAE) on T47D cells. CAE (10,20,40,60,80 µg/mL) treated on T47D cells to determined IC<sub>50</sub> value by MTT assay. Apoptosis induction is also investigated through caspase-3 expressions (IC<sub>50</sub>, 2IC<sub>50</sub>). The present study showed that CAE suppress T47D cells proliferation with IC<sub>50</sub> value of 75.81 µg/mL. The caspase-3 expression on 2IC<sub>50</sub> is higher (67.16%) than IC<sub>50</sub> (52.16%). This results indicate that CAE has ability as anticancer agent by inhibiting cell growth and induce apoptosis through caspase-3 expression on T47D cells. Further study of CAE holds potential for novel therapies of cancer prevention and treatment.

**KEYWORDS:** *Capsicum annum*, Cytotoxicity, Apoptosis

#### **INTRODUCTION:**

Cancer is defined as the abnormal cells division without control that generally occurs over an extended period of time. Breast cancer is the most frequently diagnosed cancer in females (25%) worldwide. Most breast cancer occur 100 times higher in women than that in men<sup>1</sup>. Breast cancer develops through a multistep process and the pathogenesis of this disease has not yet been elucidated<sup>2</sup>. Breast cancer incidence rates increased among Asian/Pacific women and non-Hispanic black, while were stable among non-Hispanic white, Hispanic and American Indian native women. Breast cancer is a metastatic cancer and can commonly transfer to distant organ such as the bone, brain, lung and liver<sup>3</sup>. Cancer metastasis is responsible for more than 90% of cancer-related death. Breast cancer is commonly associated with sex, estrogen, unhealthy lifestyle, family history and gene mutation<sup>4</sup>.

Normally, surgery, chemotherapy, and radiation are allowed for breast cancer therapy. However, those

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methods have limitation for uncontrolling toxicity for normal cells. Doxorubicin is a chemotherapy drug used in the treatment of several cancers including breast cancer. It acts on cancer cells through intercalation into DNA resulting in the inhibition of DNA synthesis and function leading to eventual DNA breaks<sup>5</sup>. Although doxorubicin has a lot of beneficial, however the discovery of new drug as an alternative way to cure cancer is highly needed. Plants are regarded as a prospective source for cancer treatment due to various therapeutic effects. Over 60% of the currently used anticancer agents are derived in one way or another from natural sources<sup>6</sup>.

*Capsicum annuum* L. commonly known as bell pepper exhibits proven health as well as medicinal significance. It can be consumed either in fresh (salads, salsa, pizza) or processed form as dried powder<sup>7</sup>. *Capsicum annuum* belongs to the family of Solanaceae that contain flavonoids, phenolics, carotenoids, alkaloids, and rich source of vitamin C, provitamin A, and calcium. Array of bioactive compounds suggest it a choice for preventing cell damage, cancer insurgence, diabetes prevalence, cataracts, cardiovascular disorders, Alzheimer's and Parkinson's disease. The principal ingredient present in this species is capsaicin (trans-8-methyl-N-vanillyl-6-non-enamide). The capsaicin content varies from 0.1% to 1% that recently attracted considerable attention because its anticancer properties selectively inhibit the growth of tumor cells, both *in vitro* and *in vivo*<sup>8</sup>. Despite the several known effects of naringin, this study need more validation as anticancer compound. Recently, we describe that *Capsicum annuum* extract (CAE) inhibited tumor growth and apoptosis induction shown in caspase-3 expression on T47D cells.

## MATERIAL AND METHODS:

### Ethical Clearance:

All treatment procedures under guided The Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Public Health and Nursing, Gadjah Mada University, Indonesia.

**Preparation of *Capsicum annuum* extract:** *Capsicum annuum* L. were obtained from Surabaya, East Java, Indonesia. They were cleaned and chopped into small pieces and shade-dried. They were mashed to powdery form using a mechanical blender and passed through the coarse sieve (0.2 mm). The *Capsicum annuum* L. powder was macerated with ethanol 96% for 72 h at 37 °C. The extract was hematoxylin for 2 min, then washed with distilled water. The cells were immersed in absolute ethanol

evaporated in waterbath at 60 °C. The residue was stored in a refrigerator at -4 °C.

### Cell culture of T47D cells:

T47D cells were obtained from Parasitology Laboratory, Faculty of Medicine, Public Health and Nursing, Gadjah Mada University, Indonesia. Cells were cultured in Dulbecco's modified eagle medium (DMEM) media that supplemented with fetal bovine serum 10% (v/v), streptomycin-penicillin 3% and fungizone 1% then incubated in incubator CO<sub>2</sub> 5% at 37 °C. Cells were collected after reaching 80% confluency using trypsin-EDTA 0.25%.

### Cytotoxic assay evaluation:

T47D cells 5 x 10<sup>3</sup> cells/well were implanted into 96-well plate, respectively, then incubated in incubator CO<sub>2</sub> 5% at 37 °C overnight. Cells were added with five various concentration of *Capsicum annuum* extract (10, 20, 40, 60, 80 µg/mL) for 24 h. MTT reagent (3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) 100 µL were added into each well. The cells were incubated one more time for 4 h until formazan crystals were formed. SDS-stopper HCL 0.1 N were also added to evaluate the colours for the media. The plate was wrapped in aluminium foil and incubated in dark place overnight. Colour absorption were read by ELISA reader at λ 595 nm. The inhibitory concentration 50 (IC<sub>50</sub>) value were calculated using linear regression of log concentration. Other cells, T47D and Vero were done with same method, respectively.

### Caspase-3 staining evaluation:

T47D cells were implanted in six wells 5 x 10<sup>5</sup> cells/well using sterile coverslip as a microplate and incubated in incubator CO<sub>2</sub> 5% at 37 °C overnight. The two concentration of *Capsicum annuum* extract (IC<sub>50</sub>, 2IC<sub>50</sub>) were added in each well for 24 h. The cells were harvested and washed with PBS twice. The cold methanol were used to fix the cells for 10 min. Then, the cells in coverslip were placed each on a respective slide. The cells were washed with PBS twice. Hydrogen peroxide blocking solution were added to block the cells for 10 min. The cells were washed again with PBS pH 7.2. The primary antibody (caspase-3) was added on cells for 60 min, then washed with PBS twice. Polymer neopoly was added on cells for 30 min, then washed with PBS twice. DAB was added for 3 min, then washed with distilled water for 5 min. Cells were counterstained with

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and in xylol afterward. The protein expression were analyzed under the microscope.

## RESULTS AND DISCUSSION

The viability of T47D cells were measured using MTT assay to determine the  $IC_{50}$  of *Capsicum annum* extract treatment. The result showed that all various concentrations of CAE inhibited cell growth of T47D cells. The highest viability of T47D cells is 93.16 % at dose of 10  $\mu\text{g}/\text{mL}$ . The lowest viability is 38.01 %

at dose of 80  $\mu\text{g}/\text{mL}$ . The viability of T47D cells from three other concentrations 20  $\mu\text{g}/\text{mL}$ , 40  $\mu\text{g}/\text{mL}$  and 60  $\mu\text{g}/\text{mL}$  are 86.11 %, 75.18 %, and 52.19 %. Doxorubicin also decrease the growth of T47D cells (Figure 1). Meanwhile, the results of viability on Vero cells also decrease at dose-dependent manner, 92.67 %, 88.92 %, 84.88 %, 84.88 %, 81.07 %, respectively. Doxorubicin also decrease Vero cells (Figure 2). The  $IC_{50}$  of CAE on T47D cells is 75.81  $\mu\text{g}/\text{mL}$ .

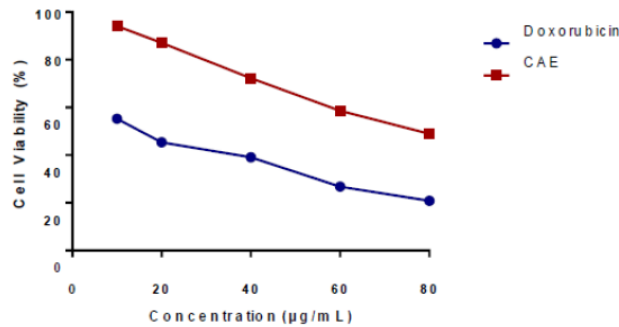


Figure 1. Viability responses of CAE and doxorubicin on T47D cells.

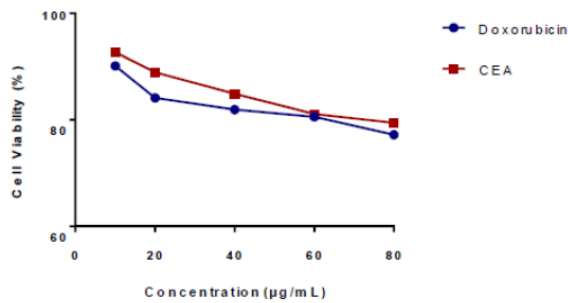


Figure 2. Viability responses of CAE and doxorubicin on Vero cells.

Breast tumor usually start from the ductal hyperproliferation, then develop into benign tumors or carcinoma after constantly by various carcinogenic factors<sup>9</sup>. In this study, the cytotoxic effect of *Capsicum annum* extract (CAE) against T47D cells as mammary tumor cell lines is investigated. CAE inhibit the growth of T47D cells with  $IC_{50}$  value 75.81  $\mu\text{g}/\text{mL}$ . This result indicate CAE potent to develop as anticancer agent. Cytotoxic activity of CAE by the content of bioactive compounds that have anticancer effects. Among the bioactive compounds isolated from CAE which has most dominant anticancer activity is capsaicin. Diverse studies have shown that capsaicin has antiproliferative effect on several human cell lines derived from multiple myeloma, pancreatic cancer, prostate cancer, colon cancer, lung cancer and gastric cancer<sup>10,11,12</sup>.



As shown in Figure 3, the exposure of T47D cells to IC<sub>50</sub> and 2IC<sub>50</sub> naringin for 24 h enhanced the number of caspase-3 expression, typical brown colour in cytoplasm of cells. The dose of 2IC<sub>50</sub> (67.16%) is higher than dose of IC<sub>50</sub> (52.16%). Control cells were not induced apoptosis due to the cells were not treated with CAE.

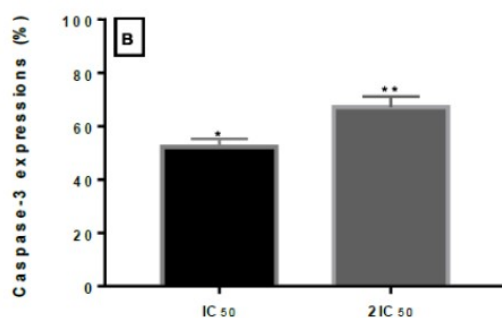
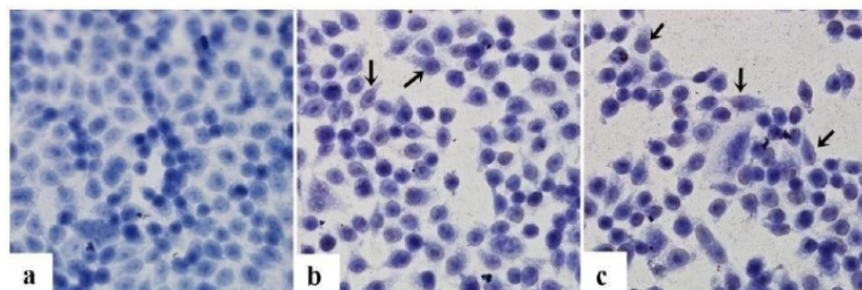


Figure 3. The effects of CAE on T47D cells. The untreated group (a); The caspase-3 expression (black arrow) shown in brown colour in cytoplasm of IC<sub>50</sub> (b); 2IC<sub>50</sub> (c); B: The bars represent mean  $\pm$  SD of caspase-3 scores. The data is the mean ( $n=3$ ) with \* $p$  value  $\leq 0.05$  when compared to IC<sub>50</sub> value.

A successful anticancer properties should kill cancer cell without causing damages to normal cells. Determining the molecular targets involved in the tumor development process will also provide opportunities to develop cancer-fighting strategy. Caspase-3 is apoptosis marker that leading cell death without making inflammation around the normal cell. This ideal situation is achievable by inducing apoptosis in cancer cells<sup>13,14</sup>. This study showed that the expression of caspase-3 of the CAE treatment 2IC<sub>50</sub> were higher compared to IC<sub>50</sub>. These data clarify that CAE induced apoptosis through caspase-3 expression. Apoptosis is an essential barrier against cancer development and progression and loss of apoptotic signaling is highly associated with malignancy<sup>15</sup>. Previous studies reported that genus of capsicum induce apoptosis through activate caspase-3 protein in HepG2 and Hep3B cells<sup>16,17</sup>. Capsaicin

may also serve as an antitumorigenic agent in human gastric cancer due to expression of proapoptotic protein such as Bax, caspase-3 and caspase-8<sup>18</sup>. Other studies showed that capsaicin induced apoptosis and cell cycle arrest at G1 phase in A172 human glioblastoma cells, PANC-1 and NPC-TW 039 cells<sup>19,20</sup>.

Other compounds also supported CAE as anticancer properties, such as flavonoids express wide variety of biological effects that may play a role in cancer therapy. It reveal potent antiproliferative, antiangiogenic, induce apoptosis and perturb cell cycle progression<sup>21</sup>. Prior studies demonstrated that phenolic exhibit anticarcinogenic, induce cell cycle arrest, inhibit oncogenic signaling cascade controlling cell proliferation, angiogenesis and apoptosis<sup>22</sup>. Carotenoids showed its ability inhibit the proliferation of several types of cancer cells and

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induced apoptosis on the cells<sup>23</sup>. Alkaloids also captures antineoplastic effect on various cancer cells<sup>24</sup>.

## CONCLUSION:

This study revealed that *Capsicum annuum* extract (CAE) inhibit cell growth with IC<sub>50</sub> 75.81 µg/mL and activate caspase-3 expression as an apoptosis marker on T47D cells. It is a interesting natural source to be developed as an anticancer properties. Further study of CAE can be modified in concentration to find the best result of cancer prevention and treatment.

## ACKNOWLEDGEMENT:

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## CONFLICT OF INTEREST:

The authors declare no conflict of interest.

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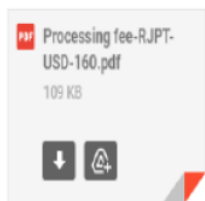
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Regards,

With reference to your article titled "Cytotoxic Effect of Capsicum annum L. Extract on T47D Cells: In vitro Study." Author by Rochmah Kurnijasanti, Amaq Fadholly. We wish to bring to your kind notice the following:

- We acknowledge the receipt of the above mentioned article.
- The above mentioned article (s) has been sent to the reviewer of expert comments.
- The above mentioned article (s) have been accepted for publication in the journal.

Thank you for submission of manuscript for publication.

Yours sincerely,  
**Dr. Mrs. Monika S. Daharwal**  
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