

Tea-tong: Innovation of Natural Breast Anticancer Adjuvant Based on Flavonoids of Centong Cactus (*Opuntia cochenillifera*) with Bioinformatics and In vitro Approaches

**ABSTRACT**

Adilah Assegaf<sup>1</sup>, Shafiyyah Farannisa Zain<sup>2</sup>  
State Junior High School 2 Semarang  
adilahassegaf123@gmail.com

Breast cancer is one of the leading causes of death in women caused by resistance to chemotherapy agents. This resistance phenomenon is closely related to increased levels of reactive oxygen species (ROS) and activation of antioxidant pathways that support the proliferation of cancer cells. This study aims to examine the potential of *Opuntia cochenillifera* extract as an anticancer agent through cytotoxic activity and molecular mechanisms against breast cancer cells with a bioinformatics approach. The extraction method is carried out through a maceration. Qualitative phytochemical analysis was carried out through color reaction tests to identify the content of alkaloids, flavonoids, tannins, saponins, and steroids, while quantitative analysis was carried out using UV-Visible and FTIR methods. Testing of anticancer activity was carried out by the MTT assay method. Furthermore, bioinformatics analysis was carried out to identify the main target of the active compound of the centong cactus extract against breast cancer cells. The results showed that the centong cactus extract contained phytochemical compounds in the form of alkaloids, flavonoids, tannins, saponins, and steroids. The level of flavonoid compounds was measured at 68 mg per gram of extract with the strain characteristics of the carboxylate group (-COOH) and the O-H group at the peak of wave absorption of  $3358\text{ cm}^{-1}$ . The MTT test produced an  $IC_{50}$  value of  $270.63\text{ }\mu\text{g/mL}$  in MDA-MB231 breast cancer cells, which showed strong cytotoxic activity. Bioinformatics analysis successfully identified six main target genes (CDKN1A, TP53, MAPK1, MAPK3, AKT1, and FOXO3) that play a role in apoptosis induction through ROS inhibition and regulation of p21 and TP53 proteins. The conclusion shows that the *Opuntia cochenillifera* extract has significant potential as an adjuvant agent of chemotherapy through cytotoxic activity and inhibition of the ROS pathway and has a molecular mechanism involving the regulation of p21 and TP53 proteins.

**Keywords:** Breast cancer, *Opuntia cochenillifera*, flavonoids, ROS, p21, TP53, bioinformatics.