



# Potential Antioxidant Adjuvant Therapies in Breastcancer Treatments

Kuban-Jankowska A\*

Department of Medical Chemistry, Medical University of Gdansk, Poland

## Keywords

Cancer; Breast cancer; Adjuvant therapy; Lipoic acid; Resveratrol; Omega-3 fatty acids

## Editorial

Adjuvant therapy is an approach to fight with cancer as a support for standard anti-tumor therapy. Standard treatment includes combination of surgery, chemotherapy and radiation. The increasing resistance of cancer cells to chemotherapy revealed growing need of utilization of the supportive therapy in cancer treatment. Resistance of cancer cells occurs when they develop the ability to keep the chemotherapy drug from entering it or reduces the amount of the drug compounds that can enter to a level that does not cause damage. It is possible due to cancer cells produce a substance called p-glycoprotein, which can remove the chemotherapy drug from the cell. Many anticancer drugs require metabolic activation and thus cancer cells can develop resistance through decreased drug activation [1]. It was found that breast cancer cells can generate drug resistance [2]. In order to counteract resistance, chemotherapy drugs are usually administered as a combination of anti-cancer compounds, in case the cancer cells will be resistant to one of the drugs in the combination. Unfortunately, once cancer cells have developed resistance to one anti-cancer compound, it is more likely to develop resistance also to other type of drugs, making treatment more difficult. Thus it is so important to select the best possible drug combination and to use it as soon as the probability of resistance is at the lowest level. The main goal of supportive therapy in clinical practice is to induce cancer cells to be more sensitive to standard chemotherapy. Lipoic Acid (LA) is one of the potential natural compounds that can be considered as a supportive therapy in breast cancer. Numerous recent studies confirmed that LA can inhibit cell proliferation or increase apoptosis of, among others, breast, thyroid, lung, leukemia and colon cancer cells and suggested the possibility of lipoic acid as a potential anticancer agent [3-9]. It has been shown that lipoic acid and its analogs may have a significant impact in cancer metabolism and can be considered in chemotherapy [10]. It has been also discovered that anti-proliferative action of lipoic acid can be possibly due to the activation of pyruvate dehydrogenase, thus inducing the suppression of aerobic glycolysis and induction of cell death [11]. LA is a short-chain fatty acid, an organo sulfur compound derived from octanoic acid and can be synthesized in the human body, but it can be also absorbed from the diet. Recent studies have confirmed that lipoic acid utilized as a dietary supplement is well tolerated and reveals no significant toxicity [12]. Antioxidant compounds such as lipoic acid can be considered as a supplement to standard anticancer treatment to enhance the inhibitory effect on tumor cells and to protect from Reactive Oxygen Species (ROS) generated by anti-cancer agents. It was found that utilization of multiple antitumor drugs is associated with the induction of ROS [13]. Alpha-Lipoic Acid (ALA), also known as thioctic acid, can be reduced to dihydro lipoic acid (DHLA). Both compounds, ALA and its reduced form DHLA, are powerful antioxidants [14]. Other antioxidants that can be used as a supplementation of standard chemotherapy are, among others, resveratrol and omega-3 fatty acids. Resveratrol is a bioflavonoid found in many plants, mostly in grapes. Red wine is the main source of resveratrol in human diet. It was already many years ago discovered and confirmed nowadays that resveratrol can inhibit the growth of estrogen receptor positive human breast cancer cells [15-17]. Omega-3 are essential polyunsaturated fatty acids necessary for human health that must be delivered from diet. Omega-3 fatty acids, such as Eicosapentaenoic (EPA) and Docosahexaenoic (DHA) Acids are found in deep water fishes, among others, in mackerel, tuna and salmon [18]. Many studies pointed to the potential value of omega-3 fatty acids as adjuvant therapy to standard chemotherapy, as it has for example enhanced the efficiency of doxorubicin and mitomycin C in breast cancer cells [19,20]. The protective role of omega-3 fatty acids enriched diet was evidenced also for prostate and colon cancer [21,22].

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### \*Correspondence:

A Kuban-Jankowska, Department of Medical Chemistry, Medical University of Gdansk, Debinki 1 Street, 80210 Gdansk, Poland,  
E-mail: alicjakuban@gumed.edu.pl

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## Conclusion

Antioxidants used as a supportive therapy, apart from the inhibitory properties against tumor cells by increasing their sensitivity to chemotherapy, may be also considered as the protection of healthy cells against free radicals and ROS produced by systemic anti-tumor drugs.

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