

**Abstract**

Modern medicine is still struggling with the problem of a fully effective treatment of neoplastic diseases, despite the use of new and innovative chemotherapeutic agents. Therefore, there is a strong need to put an appropriate emphasis on cancer prevention, which may be, inter alia, proper nutrition. Such prophylaxis could be based on the new components of the diet rich in antioxidants and other biologically active substances. One of such plants can be the beetroot (*Beta vulgaris* L.), a plant perfectly widespread in Poland since the 14th century. Most of the scientific works on the vegetable concern mainly on the mature vegetative form, while there is no comprehensive research related to its early development - young shoots, which are particularly important in terms of their health - promoting properties.

The aim of the research in this study was to compare the effectiveness of the previously unknown, potentially anti-cancer effect of young shoots of the beetroot with reference to the root at full maturity, on human cancer cells of the breast gland hormone-dependent MCF-7 and hormone-independent MDA-MB-231 lines, as well as normal MCF-12A line for control.

In this study, it was shown that the juice of young shoots, both in the native and digested form, most often caused a significantly greater reduction of the proliferation of both analyzed breast cancer cells MCF-7 and MDA-MB-231 lines, compared to the native and digested juice of the red beet root, respectively. Independently of the type of juice used, a significantly greater reduction of the proliferation of estrogen-dependent cells (MCF-7 line) was most often shown, compared to estrogen-independent cells (MDA-MB-231 line). All analyzed types of the beetroot juice, in particular the juice from young shoots and the root, which subjected the process of digestion and absorption in the gastrointestinal model tract *in vitro*, resulted in an apoptotic effect on the cells of both studied cancer lines. Moreover, a significantly stronger apoptotic effect of the digested juice, both from young shoots and from the root of red beet at full maturity, was generally demonstrated for the estrogen-dependent MDA-MB-231 cell line, compared to the estrogen-dependent MCF-7 line. Induction of the apoptosis process of breast cancer cells in both studied lines was associated with increased expression of the p53 protein, activation of proteins, mainly the mitochondrial apoptotic pathway, i.e. pro-apoptotic proteins from the Bcl-2 family, release of cytochrome c, increased expression of the HtrA2/Omi protein (in the case of the MCF-7 line) and MAP of p38 kinases (in the case

of the MDA-MB-231 line), as well as activation of the PARP protein and caspase cascades, with a simultaneous reduction in the expression of the *AKT1* gene, encoding the survival protein, as a result of the action of both analyzed types of juice.

It can also be said, that research on the role of young shoots of edible plants in the prevention of cancer, in particular red beet is at an early stage, therefore there is a need to continue them in order to comprehensively assess the factors with antiproliferative and apoptotic effects.

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