



## *Vernonia amygdalina*—Induced Growth Arrest and Apoptosis of Breast Cancer (MCF-7) Cells

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### ABSTRACT

Breast cancer is the second leading cause of cancer-related deaths of women in the United States. Fortunately, the mortality rate from breast cancer has decreased in recent years due to an increased emphasis on early detection and more effective treatments. Although great advancements have been made in the treatment and control of cancer progression, significant deficiencies and room for improvement remain. The central objective of this research was to further determine the *in vitro* mechanisms of *Vernonia amygdalina* (VA) leaf extracts as an anticancer candidate for the treatment of breast cancer. To achieve our objective, MCF-7 cells were treated with different concentrations of VA for 24 and 48 h. Cell viability, live and dead cells were determined by the means of trypan blue exclusion test. Live and dead cells were further evaluated by propidium iodide (PI) assay using the Cellometer Vision. Cell apoptosis was measured by flow cytometry assessment using annexin V/PI kit. Data obtained from the trypan blue test demonstrated that VA treatment reduces cell viability in a concentration- and time-dependent manner. Result of the PI assay showed a gradual increase in the population of necrotic cells (fluorescence positive cells) in VA-treated cells compared to the control cells (fluorescence negative cells). Treatment of these cancer cells (MCF-7) for 48 h at concentrations ranging from 250 µg/mL to 1000 µg/mL caused early signs of apoptosis resulting from phosphatidylserine externalization as judged by annexin V assay. We observed a strong concentration-response relationship with regard to VA exposure and annexin V/PI positive cells. In summary, our finding demonstrates that VA-induced cytotoxicity and apoptosis in MCF-7 cells involve phosphatidylserine externalization accompanied by secondary necrotic cell death. With previous findings in our laboratory, the data generated in the present study confirms that VA is a valuable botanical therapeutic agent for the treatment of breast cancer.

### KEYWORDS

*Vernonia amygdalina*; MCF-7 Cells; Apoptosis; Necrosis; Cellometer Imaging

### Cite this paper

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### References

- [1] J. R. Ainslie, "List of Plants Used in Native Medicine in Nigeria," Imperial Forestry Institute, Oxford, 1973, p. 42.
- [2] H. M. Burkill, "The Useful Plants of West Tropical Africa," 2nd Edition, Royal Botanical Gardens, Kew, Vol. 1, 1985.
- [3] E. B. Izevbigie, "Discovery of Water-Soluble Anticancer Agents (Edotides) from a Vegetable Found in Benin City, Nigeria," *Experimental Biology and Medicine*, Vol. 228, No. 3, 2003, pp. 293-298.
- [4] A. Tadesse, A. Gebre-Hiwot, K. Asres, M. Djote and D. Frommel, "The in Vitro Activity of *Vernonia amygdalina* on *Leishmania aethiops*," *Ethiopian Medical Journal*, Vol. 31, 1993, pp. 183-189.
- [5] A. M. Hamowia and A. M. Saffaf, "Pharmacological Studies on *Vernonia amygdalina* (Del) and *Tithonia diversifolia* (Gray)," *Journal of Veterinary Medicine*, Vol. 42, No. 2, 1994, pp. 91-97.

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- [6] B. A. Iwalokun, " Enhanced Antimalarial Effects of Chloroquine by Aqueous Vernonia amygdalina Leaf Extract in Mice Infected with Chloroquine Resistant and Sensitive. Plasmodium berghei Strains," African Health Sciences, Vol. 8, No. 1, 2008, pp. 25-35.
- [7] A. Akah and C. I. Okafor, " Hypoglycaemic Effect of Vernonia Amygdalina Del, in Experimental Rabbits," Planta Medica, Vol. 1, 1992, pp. 6-10.
- [8] C. G. Yedjou, E. Izevbigie and P. B. Tchounwou, " Preclinical Assessment of Vernonia Amygdalina Leaf Extracts as DNA Damaging Anti-Cancer Agent in the Management of Breast Cancer," International Journal of Environmental Research and Public Health, Vol. 5, No. 5, 2008, pp. 337-341. doi: 10.3390/ijerph5050337
- [9] C. B. Howard, J. Stevens, E. B. Izevbigie, A. Walker and O. McDaniel, " Time and Dose-Dependent Modulation of Phase 1 and Phase 2 Gene Expression in Response to Treatment of MCF-7 Cells with a Natural Anti-Cancer Agent," Cell and Molecular Biology, Vol. 49, No. 7, 2003, pp. 1057-1065.
- [10] C. G. Yedjou, M. A. Saeed, M. Alamgir Hossain, W. Dorsey, H. Yu and P. B. Tchounwou, " Basic Apoptotic and Necrotic Cell Death in Human Liver Carcinoma (HepG(2)) Cells Induced by Synthetic Azamacrocyclic," Environmental Toxicology, 2012, in Press. doi:10.1002/tox.21786
- [11] G. Koopman, C. P. M. Reute-lingsperger, G. A. M. Kuijten, R. M. J. Keehnen, S. T. Pals and M. H. Jr. van Oers, " Annexin-V for Flow Cytometric Detection of Phosphatidylserine Expression on B Cells Undergoing Apoptosis," Blood, Vol. 84, No. 5, 1994, pp. 1415-1420.
- [12] O. Adaramoye, B. Ogyngbenro, O. Anyaegou and M. Fafunso, " Protective Effects of Extracts of Vernonia Amygdalina, Hibiscus. Sabdaiffa and Vitamin C against Radiation-Induced Liver Damage in Rats," Journal of Radiation Research, Vol. 49, 2008, pp. 123-131. doi:10.1269/jrr.07062
- [13] A. O. Abosi and B. H. Raseroka, " In Vivo Antimalarial Activity of Vernonia amygdalina," British Journal of Biomedical Science, Vol. 60, No. 2, 2003, pp. 89-91.
- [14] E. B. Izevbigie, T. L. Bryant and A. Walker, " A Novel Natural Inhibitor of Extracellular Signal-regulated Kinases and Human Breast Cancer Cell Growth," Experimental Biology and Medicine, Vol. 229, No. 2, 2004, pp. 163-169.
- [15] C. Manach, A. Scalbert, C. Morand, C. Remesy and H. Jimenez, " Polyphenols: Food Sources and Bioavailability," American Journal of Clinical Nutrition, Vol. 79, No. 5, 2004, pp. 727-747.
- [16] A. M. Tekobo, A. O. Onabanjo, O. O. Amole and P. M. Emeka, " Analgesic and Antipyretic Effects of the Aqueous Extract of Vernonia amygdalina," West Afri. J. Pharm, Vol. 16, 2002, pp. 68-74.
- [17] S. B. Mbinglo, " Survey on the Production of Bitterleaf Vernonia spp. in Bamenda, N.W. Cameroon," Student Project Report for Natural Resource Institute, United Kingdom/Dschang University Cameroon, Chatham, 1998.
- [18] C. F. L. Onwuka, A. O. Akinsoyinu and O. O. Tewe, " Feed Value of Some Nigerian Browse Plants: Chemical Composition and in Vitro Digestibility," East African Agricultural and Forestry Journal, Vol. 54, 1989, pp. 157- 163.
- [19] E. M. K. Aregheore, H. P. S. Makkar and K. Becker, " Feed Value of Some Browse Plants from the Central Zone of Delta State," Nig. Trop. Sci, Vol. 38, 1998, pp. 97-104.
- [20] H. Kim, S. You, B. Kong, L. Foster, J. Farris and D. Foster, " Necrotic Cell Death by Hydrogen Peroxide in Immortal DF-1 Chicken Embryo Fibroblast Cells Expressing Deregulated MnSOD and Catalase," Biochimica et Biophysica Acta, Vol. 1540, 2001, pp. 137-146.
- [21] C. G. Yedjou and P. B. Tchounwou, " In Vitro Assessment of Oxidative Stress and Apoptotic Mechanisms of Garlic Extract in the Treatment of Acute Promyelocytic Leukemia," Journal of Cancer Science and Therapy, Vol. 10, No. 4, 2012, pp. 1948-1956. doi:10.1016/S0167-4889(01)00131-8
- [22] A. A. Adjei and E. K. Rowinsky, " Novel Anticancer Agents in Clinical Development," Cancer Biology & Therapy, Vol. 2, 2003, pp. 5-15.
- [23] G. M. Cragg, D. J. Newman and K. M. Snader, " Natural Products as Sources of New Drugs over the