# An overview of the anti-cancer properties of some plants used in traditional medicine in Nigeria

**Taye T. Alawode**

Department of Chemical Sciences, Federal University Otuoke, Bayelsa State, Nigeria

**Cancer is a leading cause of death in man. Treatment of cancer usually involves a combination of surgery, radiation therapy, and chemotherapy but despite these therapeutic options, cancer remains associated with high mortality. As chemotherapy destroys the normal cells along with cancer cells, biological active components from plants are significant and important source of new drugs that are likely to lead to new drugs that will likely lead to new and better treatments for cancer. Various cancer and cancer-related conditions have been treated for ages by local herbalists and many plants have been reported as useful in the management of such conditions. However, there is little or no literature on the anticancer properties of medicinal plants used in ethnomedicine in Nigeria. This review seeks to justify, scientifically, the use of some of the plants used by traditional medical practitioners in the treatment of cancer in Nigeria.**

**Keywords**: Chemotherapy, cancer, ethnomedicine, herbalists.

## INTRODUCTION

Cancer is a dreadful disease caused by abnormal and uncontrolled cell division. Cancer, after cardiovascular disease, is the second leading cause of death (Kutluk and Kars, 1998; Turkistan, 2005). Out of about 10 million people diagnosed of cancer every year about 6 million die of the disease (Pinar, 1998). Deaths from cancer worldwide are projected to continue rising with an estimated 12 million deaths by 2030(Wang *et al.*, 2007). The major causes of cancer are smoking, dietary imbalances, hormones and chronic infections leading to chronic inflammation (Ames and Gold, 1995). The most frequent types of cancer worldwide in order of the number of global deaths are: among men- lung, stomach, liver, colorectal, oesophagus and prostate; and among women- breast, lung, stomach colorectal and cervical (Abiodun *et al.*, 2010). Treatment of cancer usually involves a combination of surgery, radiation therapy, and chemotherapy but despite this therapeutic options, cancer remains associated with high mortality. Various cancer and cancer-related conditions have been treated for ages by local herbalists for ages (Sofowora, 1984) and many plants have been reported as useful in the management of such conditions. As chemotherapy destroys the normal cells along with cancer cells, biological active components from plants are significant and important source of new drugs that are likely to lead to new drugs that will likely lead to new and better treatments for cancer. Plants have produced many anticancer drugs such as taxanes and vincristine and still serve as a veritable source of new products through the use of standard bioassay methods (Noble *et al.*, 1959; Wani *et al.*., 1971). According to an estimate, 50% of breast cancer and 37% of prostate cancer patients use herbal products (Richardson, 2001).However, there is little or no literature on the anticancer properties of medicinal plants used in ethnomedicine in Nigeria. This review aims to provide a scientific basis for the claimed anticancer properties of some of these plants.

The plants studied for their anticancer activity are described below:

***Allium ascalonicum*** (Shallot, Spring Onion)

It is a member of *Liliaceae* family. It is called ‘alubosa-elewe’ in Yorubaland, ‘albasa maigo’ in Hausaland. It has been widely used as a spice traditionally since ancient times. It has many different benefits including

antioxidant(Leelarungrayub *et al.*., 2006), antifungal and antibacterial properties(Yin and Tsao, 1999; Amin and Kapadnis, 2005). Mohammadi-Motlagh H. *et. al* (2011) evaluated the effects of the aqueous extract of *A. ascalonicum* on viability of the three cancer cell lines including K562, Wehi164 and Jurkat, and normal cell line (HUVEC) using Trypan blue and LDH assays evaluation. On the basis of obtained results, after 24, 48 and 72 h of incubation, the extract significantly reduced the viability of three cell lines at different concentrations compared with the control group, and these effects were stronger as time increased. The cytotoxic effects of *A. ascalonicum* for Wehi164 cell line were considerably lower than those on K562 and Jurkat cell lines. Treatment of HUVECs as normal cell lines with the aqueous extract of the *A. ascalonicum* bulbs up to 1000 µg/ml or even higher concentrations for 72 h showed no considerable cytotoxic effect on the HUVECs. At 1000 µg/ml, there was no significant difference in viability between the test and control wells. The antiproliferative activity of the *A. ascalonicum* extract on the cancer cell lines was determined by the Coulter counter. After treatment with 25-200 µg/ml and higher concentrations of the extract for 72 h, the proliferation ratio of K562 and Jurkat cell lines decreased gradually as compared with controls. However, the extract could not inhibit the proliferation of Wehi164 cell line significantly at similar concentrations, unless they are higher than 400 µg/ml. These results showed that *A. ascalonicum* inhibited the proliferation of all cell lines in a dose-dependent manner. K562 and Jurkat cells showed the highest susceptibility ($GI_{50}$: 100µg/ml), and Wehi164 cells displayed the lowest susceptibility to *A. ascalonicum* with $GI_{50}$ at 400µg/ml.

***Allium cepa*** (Onion)

It is also a member of the *Liliaceae* family. It is variously called ‘alubosa’ in Yorubaland, ‘albasa’ in Hausaland, ‘yabasi’ in Igboland, ‘alubarha’ in Edo and ‘oyim mbakara’ in Efik/Ibibio . It is used in ethnomedicine in the treatment of cough, as a diuretic, an anthelmintics, in the treatment of skin diseases, throat infections, and as a rubefacient. Ethanol (95%) extract of onion, administered to cats and rats at dose of 50mg/kg, produced weak activity on Sarcoma III (MKT). Essential oil applied externally on female mice at a dose of 1mg/animal has been reported to be effective against carcinoma induced by twice weekly 12-O-tetradecanoyl-phorbol-13-acetate promotion for two weeks, followed by mezerein promotion for 18 weeks (Fulda, 2008 cited in Nath, 2010). The dose, when given with a second promoter, produced a 32% decrease in incidence of papiloma in 7,12-dimethylbenz[α]anthracene (DMBA)-induced carcinogenesis. Hot water extract of fresh bulb applied externally on mice was active against DMBA-induced carcinogenesis. Epidemiological data both support and refute, the concept that higher intake of onions is positively related to lower risk for carcinoma. It has been noted that persons in the highest consumption category versus the lowest has a 50% reduced risk of cancers of the stomach, alimentary and respiratory tracts. Onion is one of the richest source of organosulphur compounds. Organosulphur compounds such as diallyldisulphide, S-allylcysteine and S-methylcysteine have been shown to inhibit colon and renal carcinogenesis (Simone Fulda, 1986 cited in Nath *et al.*., 2010).

***Ananas comosus*** (Pineapple)

It belongs to the family *Bromeliaceae.* It is called ‘Ope-Oyinbo’ in Yorubaland,’ ’Akwu-mbe’ in Igboland, and ‘Nkwu aba/abara’ in Hausaland. The unripe fruit, juice and ripe fruit and been used locally in the treatment of digestive problems, typhoid fever, and cough. Stem bromelain is a major cysteine proteinase, isolated from pineapple (*Ananas comosus*) stem. Its main medicinal use is recognized as digestive, in vaccine formulation, antitumoral and skin debrider for the treatment of burns. In order to verify the identity of the principle responsible for the antitumoral activity of the stem fractions, Roxana *et al.*., 2007 isolated bromelain from the stem fractions of adult pineapple plants and evaluated to probe its *in vivo* antitumoral/antileukemic activity using the following panel of tumor lines: P-388 leukemia, sarcoma (S-37), Ehrlich Ascetic Tumor (EAT), Lewis Lung Carcinoma(LLC), MB-F10 melanoma and ADC-755 mammary adenocarcinoma. Intraperitoneal administration of bromelain (1, 12.5, 25 mg/kg), began 24 h after tumor cell inoculation in experiments in which 5-fluorouracil (5-FU, 20 mg/kg) was used as positive control. The antitumoral activity was assessed by the survival increase (% survival index) following various treatments. With the exception of MB-F10 melanoma, all other tumor-bearing animals had a significantly increased survival index after bromelain treatment. The largest increase (approximately 318 %) was attained in mice bearing EAT ascites and receiving 12.5 mg/kg of bromelain. This antitumoral effect was superior to that of 5-FU, whose survival index was approximately 263 %, relative to the untreated control. Bromelain significantly reduced the number of lung metastasis induced by LLC transplantation, as observed with 5-FU. The antitumoral activity of bromelain against S-37 and EAT, which are tumor models sensitive to immune system mediators, and the unchanged tumor progression in the metastatic model suggests that the antimetastatic action results from a mechanism independent of the primary antitumoral effect.

***Allium sativum*** (Garlic)

It belongs to the family *Lilaceae*. It is variously called

'Aayu' in Yorubaland and 'Ayo-ishi' in Igboland and 'Tafarunua' in Hausaland. The bulb is used in ethnomedicine to treat fever, coughs, asthma, dialated bronchi, flatulence, as an anthelmintic, antibiotic, diuretic, antimicrobials, blood tonic, and emmenagogue. When garlic oil was topically applied during the initiation phase of benzo(a)pyrene (BP) induced carcinogenesis in mice, a decline was noted in the incidence and multiplicity of tumours. Oral administration of fresh water extract of garlic was shown to result in reduction of chemically induced cervical carcinomas in mice. Garlic treatment inhibited development of murine transitional cell carcinomas significantly (Sadhana *et al.*, 1988; Hussain, 1990; Riggs *et al.*, 1997 cited in Das, 2002). Sengupta et. al (2002) observed that fresh garlic juice administered orally can prevent development of azoxymethane (AOM) induced aberrant crypt foci and adenocarcinoma in rat colon. Epidermiologic and laboratory studies suggest that allium vegetables and garlic constituents have antitumor effects. Garlic contains several potentially important agents that possess antitumor and anticarcinogenic properties. Several compounds are involved in garlics possible anticancer effects. Garlic contains allyl sulphur and other compounds that slow or prevent the growth of tumor cells (Hsing *et al.*, 2002; Agarwal, 1996). The efficacy of various garlic derived compounds in inhibiting experimental carcinogenesis has been investigated by many. It was demonstrated that diallylsulfide (DAS), diallyltrisulfide (DAT), allylmethyldisulfide (AMD) and allylmethyltrisulfide (AMT) inhibit gastric malignancy induced by BP in mice (Sparnins *et al.* 1986,1988).Wattenberg *et al.* (1989) reported that DAS, disulfide derivatives (DADS), AMT and S-allylcysteine (SAC) could reduce nitroso compound induced forestomach tumours in mice and Wargovich *et al.* (1988) had noted that these compounds inhibited development of papilloma and squamous cell carcinoma in oesophageal tissue in rat. Fukushima *et al.* (1997) analysed the potential of several organosulfur compounds present in garlic and onion and observed inhibitory effect of DAS on renal and coloncarcinogenesis in rat induced by diethylnitrosamine (DEN).

***Bryophyllum pinnata*** (Resurrection plant, Life plant)

It belongs to the family *Crassulaceae.* It is called 'Abamoda' in parts of Nigeria. The leaves, roots and leave sap are used by traditional medical practitioners to treat cough, epilepsy, abscesses, diarrhea, wounds, fever, as sedatives, diuretic, antifungal, and antimicrobial. Mahata *et al.*, 2012 characterized chloroform fractions of *B. pinnata* for phytochemical compounds by TLC, HPTLC and NMR and biological activity of the fractions were examined based by MTT-based cell viability assay, Electrophoretic Mobility Shift Assay, Northern blotting and assay of apoptosis related proteins by immunoblotting in human cervical cancer cells. The results showed presence of growth inhibitory activity in the crude leaf extracts with $IC_{50}$ at 552µg/ml which resolved to fraction F4(Petroleum Ether: Ethylacetate 50:50) and showed $IC_{50}$ at 91µg/ml. Investigations of anti-viral activity of the extract and its fraction revealed a specific anti-HPV activity on cervical cancer cells as evidenced by downregulation of constitutively active AP1 specific DNA binding activity and suppression of oncogenic c-Fos and c-Jun expression which was accompanied by inhibition of HPV18 transcription. In addition to inhibiting growth, fraction F4 strongly induced apoptosis as evidenced by an increased expression of the pro-apoptotic protein Bax, suppression of the anti-apoptotic molecules Bcl-2, and activation of caspase-3 and cleavage of PARP-1. Phytochemical analysis of fraction F4 by HPTLC and NMR indicated presence of activity that resembled Bryophyllin A. The study demonstrates presence of anticancer and anti-HPV activity in *B.pinnata* leaves that can be further exploited as potential anticancer, anti-HPV therapeutic for treatment of HPV infection and cervical cancer.

***Chenopodium ambrosioides*** (Wormwood)

It belongs to the family *Chenopodiaceae*. It is called 'Ewe-imi', 'Asin', 'Arunpale' in parts of Nigeria. The whole plant and leaves are used as Anthelmintics, emollient, and to treat rheumatism and tumour in parts of the country. The hydroalcoholic extract of wormseed leaves exhibits anti-tumour activity in mice (Nascimento *et al.*., 2006). Ascaridol from *C. ambrosioides* exhibits in vitro antineoplastic activity in different tumor cell lines (Efferth *et al.*., 2002). Sowemimo A.A. *et al.*, 2007 found that *Chenopodium ambrosioides* whole plant was non-toxic to brine shrimps and rat lymphocyte chromosomes but showed inhibition in the conventional telomerase assay indicating a possible selectivity for human chromosomes. The result justified the use of *Chenopodium ambrosioides* in the management of cancer in south west Nigeria. *Chenopodium ambrosioides* is also found to be neither mutagenic nor cytotoxic.

***Citrus aurantifolia*** (Lime, swing)

It belongs to the family *Rutaceae*. It is called 'Osan wewe' in Yorubaland, and 'Dankabuya' in Hausaland. The leaves, stem, root and fruits are used to treat fever, jaundice, abdominal ulcer, gonorrhea, measles, cough, toothache, as hypertensive recipe, flavouring agent, antimicrobials, and carminative. Patil *et al.* (2008) subjected fruits of *Citrus aurantifolia* to hydro-distillation to obtain volatile oil. Chemical composition of volatile oil

was analyzed by GC-MS. Twenty-two compounds representing more than 89.5% of the volatile oil were identified. D-limonene(30.13%) and D-dihydrocarvone (30.47%) were found to be the major compounds in the lime volatile oil. This oil showed 78% inhibition of human colon cancer cells (SW-480) with 100µg/ml concentration at 48 h. Lime volatile oil showed DNA fragmentation and induction of caspase-3 up to 1.8 and 2- folds after 24 h and 48 h, respectively, which may be due to the involvement of apoptosis. Analysis of apoptosis-related protein expression further confirmed apoptosis induction by lime volatile oil. The results suggested that lime volatile oil has potential benefits in colon cancer prevention. This is the first report, showing the possible mechanism of antiproliferative effect of lime volatile oil for the prevention of colon cancer in cell culture models.

***Calotropis procera*** (Giant milk weed, Sodom apple)

It belongs to the family *Asclepiadaceae*. It is called 'Bomubomu' in Yorubaland, and 'Tumfatiya' in Hausaland. The leaves, root, bark and latex are used in the treatment of diarrhea, dysentery, elephantiasis, leprosy, chronic eczema, ringworm, cough, asthma, convulsion, as an abortifacient, antipyretic and diaphoretic by traditional medical practitioners. Mathur *et al.* (2009) investigated the anti-tumour potential of methanol, hexane, aqueous and ethylacetate extracts for possible mechanism against Hep2 cancer cells. Cellular proliferation activities were assayed by tetrazolium bromide (MTT) colorimetry. Morphological changes of cancer cells were observed under inverted microscope and cell cycle parameters were determined by flow cytometry following propidium iodide staining. Treatment with the extracts at various doses of 1, 5, 10 and 25 µg/ml revealed that methanol, hexane and ethylacetate extracts possessed cytotoxicity, whereas aqueous extract did not have cytotoxic effect. Ethylacetate extract (10µg/ml) showed strongest cytotoxic effect (96.3%) on Hep2 at 48 hr following treatment, whereas methanol and hexane extracts showed cytotoxicity of 72.7 and 60.5% respectively. Extract-treated cells exhibited typical morphological changes of apoptosis. Results of flow cytometric analysis clearly demonstrated that root extracts initiated apoptosis of Hep2 cells through cell cycle arrest at S phase, thus preventing cells from entering G2/M phase. Results of the study indicate that the root extracts of *C. procera* inhibit the proliferation of Hep2 cells via apoptotic and cell cycle disruption based mechanisms. Khasawneh M. A. *et. al* (2011) studied the biological, antioxidant, anti-inflammatory and anti-cancer properties of *Calotropis procera* alcoholic extract and its various solvent subfractions. The study showed that the ethylacetate fraction showed the strongest cytotoxic effect ($IC_{50}$ =10.6 µg/mL) against MCF-7 breast cancer cell line.

***Elaeis guineensis*** (Red oil palm)

It belongs to the family *Arecaceae*. It is called 'Ope' in Yorubaland 'Nkwe', in Igboland and 'Kwakwar' in Hausaland. The root, palm oil, bark and kernels are used in the treatment of malaria, mental disorders, diarrhea, asthma, and measles. Vijayarathna and Sasidharan (2012) investigated the cytotoxic effect of *Elaeis guineensis* on MCF-7 and Vero cell. *In vitro* cytotoxicity was evaluated by MTT assay. Cell morphological changes were observed using light microscope. The MTT assay indicated that methanol extract of the plant exhibited significant cytotoxic effects on MCF-7. Morphological alteration of the cell lines after exposure with *Elaeis guineensis* extract were observed under phase contrast microscope in dose dependent manner. The results suggest the probable use of the *Elaeis guineensis* methanol extract in preparing recipes for cancer-related ailments. Evidences of anti-cancer effects of vitamin E (tocopherols and tocotrienols) and their isomers in palm oil have been reported in a comparative study of the effects of tocotrienols and alpha-tocopherols on breast cancer. Results indicated that the tocotrienols fractions were able to induce an inhibitory action on the human breast cancer cells, whereas the alpha-tocopherols were not able (Nesaretnam *et al.*., 2004, 2008; MeIntyre *et al.*., 2000 cited in Obahiagbon F. I.,2012).

***Kigelia Africana*** (Sausage tree)

It belongs to the family *Bignoniaceae*. It is called 'Pandoro' in Yorubaland, 'Rawuya' in Hausaland, and 'Uturubein' in Igboland. Its root, stem bark, fruits and leaves are used locally in the treatment of kidney disorders, malaria, dysentery, rheumatism, gonorrhea, haemorrhage, spleen infection, cough, leucorrhoea and as an astringent. The root bark is recommended for the treatment of cancer of the uterus. The extract has been tested against melanoma cells (a tumour of pigmented skin cells, which can develop into malignant melanoma-the potentially fatal form of skin cancer). The extract inhibited the growth of cultured melanoma cells to a significant degree. The extract of stem bark and fruit are reported for their cytotoxic activities and showed promising results in treating melanoma and renal carcinoma (Msouthi and Mangombo, 1983; Houghton *et al.*., 1994 cited in Gabriel and Olubunmi, 2009).

***Mangifera indica*** (Mango tree)

It belongs to the family *Anacardiaceae*. It is called 'Mangoro' in Yorubaland, 'Mango sawamsop' in Igboland

and 'Mangolo' in Hausaland. The leaves, root and stem bark is used in ethnomedicine to treat malaria, diarrhea, asthma, cough, diabetes, skin lesions, high blood pressure, haemorrhage, insomnia, insanity, as anthelmintics, antimicrobials and emmenagogue. Noratto *et al.* (2010) compared the anticancer properties of polyphenolic extracts from several mango varieties (Francis, Kent, Ataulfo, Tommy Atkins and Hadin) in cancer lines, including Molt-4 leukemia, A-549 lung, MDA-MB-231 breast, LnCap prostate, and SW-480 colon cancer cells and non-cancer colon cell line CCD-18Co. The efficacy of extracts from all mango varieties in the inhibition of cell growth was tested in SW-480 colon carcinoma cells, where Ataulfo and Haden demonstrated superior efficacy, followed by Kent, Francis, and Tommy Atkins. At 5 mg of GAE/L, Ataulfo inhibited the growth of colon SW-480 cancer cells by approximately 72% while the growth of noncancer colonic myofibroblast CCD-18Co cells was not inhibited. The growth inhibition exerted by Ataulfo and Haden polyphenolics in SW-480 was associated with an increased mRNA expression of pro-apoptotic biomarkers and cell cycle regulators, cell cycle arrest, and a decrease in the generation of reactive oxygen species. Overall, polyphenolics from several mango varieties exerted anticancer effects, where compounds from Haden and Ataulfo mango varieties possessed superior chemopreventive activity. Percival S *et al.*., (2010) screened whole mango juice and juice extracts for antioxidant and anticancer activity. They measured anticancer activity by examining the effect on cell cycle kinetics and the ability to inhibit chemically induced neoplastic transformation of mammalian cell lines. Incubation of HL-60 cells with whole mango juice and mango juice fractions resulted in an inhibition of the cell cycle in the $G_0/G_1$ phase. A fraction of the eluted mango juice with low peroxyl radical scavenging ability was most effective in arresting cells in the $G_0/G_1$ phase. Whole mango juice was effective in reducing the number of transformed foci in the neoplastic transformation assay in a dose-dependent manner. The chemopreventive effects of mangiferin for both the initiation and post-initiation phases of azoxymethane (AOM; alkylant, 15 mg/kg body weight, s.c., once a week for 3 weeks) - induced colon carcinogenesis was examined in rats by Yoshimi *et al.*. (2001). In a short-term assay (5 weeks, development of AOM-induced preneoplastic lesions), mangiferin (0.1% in the basal diet for 5 weeks) significantly inhibited the aberrant crypt foci development in AOM-treated rats (~40% less). In a long-term assay (40 weeks), the group treated with mangiferin during the AOM initiation phase had significantly lower incidence and multiplicity of intestinal neoplasms (>40% reduction) with reduced colonic mucosa cell proliferation (65-85% decrease).

***Psorospermum febrifugum***

It is called 'Legun-oko' in south western Nigeria. Kupchan et. al (1980) reported the isolation of a new antileukemic xanthone, psorospermin from an ethanolic extract of *Psorospermum febrifugum* when it was fractionated with antileukemic activity in vivo in the P388 lymphocytic leukemia in mice and *in vitro* in the KB cell culture system used as a guide. Psorospermin was demonstrated to have significant antitumor activity in the P388 *in vivo* system as well as cytotoxicity against the KB in *in vitro* system. Marston *et. al* (1986) isolated five anthranoid pigments, including a new anthraquinone and a new tetrahydroanthracene, from the root bark of *Psorospermum febrifugum* Spach (Guttiferae). Cytotoxic activity of these pigments against the human colon carcinoma cell line Co-115 was investigated. The tetrahydroanthracenes vismione D and acetylvismione D exerted reproducible cytotoxicity in this new *in vitro* test system.

***Annona muricata*** L (Soursop)

It belongs to the family *Annonaceae*. It is commonly called 'sharp-sharp' in parts of Nigeria. The fruits and the leaves are also used in the treatment of dysentery and fever in parts of the country. Hamizah *et. al* (2012) evaluated the chemopreventive effects of ethanolic extracts of leaves of *A. muricata* (AMLE) in 6-7 week old ICR mouse given a single topical application of 7,12-dimethylbenza(α)anthracene (DMBA 100µg/100µl acetone) and promotion by repeated application of croton oil (1% in acetone/twice a week) for 10 weeks. Morphorlogical tumor incidence, burden and volume were measured, with histological evaluation of skin tissue. Topical application of AMLE at 30, 100 and 300mg/kg significantly reduced DMBA/croton oil induced mice skin papillomagenesis in (i) peri-initiation protocol (AMLE from 7 days prior to 7 days after DMBA), (ii) promotion protocol (AMLE 30 minutes after croton oil), or (iii) both peri-initiation and promotion protocol (AMLE 7 days prior to 7 day after DMBA and AMLE 30 minutes after croton oil throughout the experimental period), in a dose dependent manner ($p<0.05$) as compared to carcinogen–treated control. Furthermore, the average latent period was significantly increased in the AMLE-treated group. Interestingly, at 100 and 300 mg/ kg, AMLE completely inhibited the tumor development in all stages. Histopathological study revealed that tumor growth from the AMLE-treated groups showed only slight hyperplasia and absence of keratin pearls and rete ridges. The results, thus suggest that the *A. muricata* leaves extract was able to suppress tumor initiation as well as tumor promotion even at lower dosage. Rachmani et. al (2012) determined the cytotoxic effects of extracts of leaves of

*A. muricata* and its fractions in cancer cells T47D. Extraction was carried out with ethanol and fractionation by column chromatography method, n-hexane, chloroform, ethylacetate and methanol were used. Cytotoxicity was determined using MTT assay and apoptosis tests was performed by Double Stainning method. The results showed that ethanol extracts has a $IC_{50}$ value of 17.149µg/mL. Fraction F3 has the best cytotoxic activity with $IC_{50}$ value of 30.112µg/mL. Apoptosis assay results showed that the fraction F3 was able to induce apoptosis of cells.

***Vernonia amygdalina***

Yedjou *et. al* (2008) assessed the therapeutic efficacy of *Vernonia amygdalina* (VA) leaf extracts as anti-cancer agent against human breast cancer in vitro using the MTT [3-(4, 5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide and alkaline single cell gel electrophoresis (Comet) assays, respectively. In this experiment, human breast adenocarcinoma (MCF-7) cells were treated with different doses of VA leaf extracts for 48 hours. Data obtained from the MTT assay showed that VA significantly (($P < 0.05$) reduced the viability of MCF-7 cells in a dose-dependent manner upon 48 hours of exposure. Data generated from the comet assay also indicated a slight dose-dependent increase in DNA damage in MCF-7 cells associated with VA treatment. A slight increase in comet tail-length, tail arm and tail moment, as well as in percentages of DNA cleavage at all doses tested, showed an evidence that VA-induced minimal genotoxic damage in MCF-7 cells. Taken together, this suggests that VA treatment moderately ($P < 0.05$) reduces cellular viability and induces minimal DNA damage in MCF-7 cells. These findings provide evidence that VA extracts represent a DNA-damaging anti-cancer agent against breast cancer and its mechanisms of action functions, at least in part, through minimal DNA damage and moderate toxicity in tumors cells. Anastasia (2011) discussed the multi-faceted and multi-linked mechanisms by which cancer tissue inhibition and destruction is achieved by *Vernonia amygdalina* extract. Cancer cell inhibition by *V. amygdalina* is suggested to occur through inhibition of sterol 14-α-demethylase, a microsomal P450-dependent enzyme system) of the membrane of the cancer cell. Inhibition of this enzyme impairs the biosynthesis of ergosterol for the cytoplasmic membrane. This impairment of the synthesis of ergosterol disrupts the close packing of acyl chains of phospholipids and impairs the function of some membrane-bound enzyme systems like ATPase and enzymes of electron-transport system of the cancer cells. *V. amygdalina* extract inhibits sterol 14-α-demethylase by acting on β3 adrenergic receptors of the cancer cell membranes as a primary ligand in Gi (inhibitory) receptors on cancer β3 lipid cell membrane receptors and mitochondrial ATP energy generation system receptors. By effecting β-oxidation of fatty acids and lipids in cell membranes and cell mitochondrial energy (ATP) generation systems, the *V. amygdalina* extract uncouples the mitochondrial energy (ATP generation) systems of the cancer cells and cell membranes resulting in the cancer cells being burnt out (consumed) by the extract (when *V. amygdalina* extract is cytotoxic to the cancer cells) or its functioning being inhibited (when *V. amygdalina* extract is only inhibitory to the cancer cells).

***Securidaca longepedunculata***

It belongs to the family *Polygalaceae*. It is called ‘Uwar Magunguna’ in Hausaland, literally translated "the mother of all drugs" a tribute to its very numerous medicinal uses. Lawal (2012) studied to determine the in vitro and in vivo cytotoxic activity and possible pro-apoptotic effect of *Securidaca longepedunculata* aqueous extract (SLE) on Ehrlich ascites carcinoma cells. *In vitro* cytotoxic activity was determined using the Trypan blue assay by incubating Ehrlich ascites carcinoma cells with 0.1, 1, 10, 100 and 1000 µg/ml of *Securidaca longepedunculata* aqueous extract. *In vivo* study was carried out by intraperitoneal administration of doses of 10, 25, 50 and 75 mg/kg bodyweight of SLE to tumour-bearing mice. Isolated DNA from Ehrlich ascites carcinoma cells in treated and untreated animals was used for DNA fragmentation assay on agarose gel. *Securidaca longepedunculata* aqueous extract, SLE was cytotoxic to Ehrlich ascites both *in vivo* and *in vitro*. The $IC_{50}$ of SLE was 67µg/ml. SLE caused a decrease in angiogenesis as observed in the reduction in weight of treated animals and a reduction in volume of ascitic fluid in treated mice. DNA fragmentation assay of Ehrlich ascites carcinoma cells from treated animals and apoptotic blebbing, as visualized under giemsa staining, also depicted a possible pro-apoptotic effect of the *Securidaca longepedunculata* extract due to the ladder forming pattern which was comparable to that of the standard drug (fluorouracil).

***Plumbago zeylanica***

It belongs to the family *Plumbaginaceae*. It is called ‘inabiri’ in south western Nigeria. The roots pounded with vegetable oil are used as a treatment for rheumatic swellings in some parts of Nigeria. Datta (2012) reported that Plumbagin, isolated from the roots of *Plumbago zeylanica* significantly suppressed growth of Raji, Calu-1, HeLa, and Wish tumor cell lines. Hiradeve *et al.* (2010)

evaluated *Plumbago zeylanica* leaf extract against Ehrlich Ascites Carcinoma in animal model. Reports indicated that the ethanolic extract of *Plumbago zeylanica* Linn possess significant anticancer activity and also reduce elevated level peroxidation due to higher content of terpenoids and flavonoids. Thus, ethanolic extract of *Plumbago zeylanica* Linn could have vast therapeutic application against cancer.

## CONCLUSION

Plants have played a remarkable role in health care since the ancient times. Traditional plant based medicines still exert a great deal of importance to people living in developing countries and also lead to discovery of new drug candidates. However, scientific evaluation of medicinal plants to validate their use is necessary. The persistence of high mortality rate among cancer patients is a pointer to the limited efficiency of the current therapies used in cancer treatment. For many years, search for cure of cancer has focused on chemically synthesized compounds. In the last few decades, research has focused on the use of natural products such as crude plant extracts or a combination of different phytochemicals for cancer therapy.

As can be seen from above many of the plants used in the ethnomedicine in Nigeria have scientifically justifiable basis for their use. Such plants may be sources of drugs for cancer treatment in the future.

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