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Anti-Colon Activity in Ethanolic Extract of *Phytolacca americana*

Idress Hamad Attitalla

Department of Botany, Faculty of Science, Omar El-Mukhtar University, Box 919, El-Bayda, Libya

Although many improvements have been made in anticancer therapies, still in population with less than an age of 85 years; it accounts for more deaths than heart failure (Jemal *et al.*, 2010). Within year 2010 only in United States, total 1,529,560 persons were the new victims of it, which resulted in death of more than 5 million peoples. It is also a serious health problem in Asian countries, where the colon, prostate and breast cancers, previously considered as typical for developed countries are getting peak (Park *et al.*, 2008). Their incidence increases with an increase in intake of alcoholic drink, high fat and calorie food, although some reproductive factors are also responsible for it. Breast cancer can be identified by the increase in total cholesterol, triglyceride levels and body mass index (Owiredu *et al.*, 2009). As all these parameter were significantly high in both pre-menopausal and post menopausal breast cancers. While the colon cancer proliferates due to rapid propagation of CD133⁺ cells and presence of these cells can help in correct diagnosis of cancer (Ricci-Vitiani *et al.*, 2007). The cancer cells can be prohibited by the use of chemotherapeutic drugs e.g., aprepitant, mirtazapine, olanzapine etc., but their efficiency needs more scientific support (Kast and Altschuler, 2006). Moreover, the nervous system is often readily degraded by the use of anti-cancer chemical compounds, which cause neurotoxicity (Kassem and Yassin, 2010). It results in allodynia, hyperalgesia and burning sensation, thus ceases the further progression of chemotherapy. Nowadays cancer treatment through plants products is highly studied area and this may give more reliable anti-cancer results. Plant extracts are known for their potent activity against major health issues like diabetes, viral diseases cancer and many more; as anticancer agent they inhibit the growth of non-differentiating cancerous cells (Aisha *et al.*, 2009; Karim *et al.*, 2011; Sohail *et al.*, 2011). These can induce apoptosis in cancer cells, as the ethanolic extracts of *Sargassum thunbergii* and *Dictyopteris divaricata* have developed apoptotic bodies on cancerous cell surface (Kim *et al.*, 2009). Moreover, these extracts also cause the shrinkage and irregular bulging of these cells. Thus the plants can efficiently act as an alternative source of anti-cancer properties.

Phytolacca americana is an antioxidant plant and it has the ability to reduce the heavy metal caused oxidative

stress (Zhang *et al.*, 2009). This may also help in reducing the oxidative stress of cancer, as the lipid peroxidation in colon cancerous rat was significantly inhibited by the application of an antioxidant compound (Thirupurasundari *et al.*, 2009). Recently, Maness *et al.* (2012) studied *P. americana* for its antiproliferative property against human colon (HCT-116) and breast cancer cells (MCF-7). They tested its ethanolic (PRE), methanolic (PRM) and water (PRW) extracts against the proliferation of both these cells. Although, these extracts stopped the growth of HCT-116 cells, the MCF-7 remained uninfected, thus antiproliferative property of plants extracts was cancer type dependant. The further investigation on these extracts exposed the excellent concentration dependant activity of PRE extracts. Although other extracts (PRM and PRW) were also effective, the PRE extracts were most significantly effective. The effect of these concentrations was also determined by the time of incubation. As the 400 $\mu\text{g mL}^{-1}$ PRE inhibited 0% of colon after 48 and 72 h, while 3200 $\mu\text{g mL}^{-1}$ PRE inhibited 17 and 20% of colon, respectively. On the other hand the PRM (least effective) inhibited more than 5% colon only after 72 h implantation of 1600 $\mu\text{g mL}^{-1}$. Whereas PRW concentrations: 800, 1600 and 3200 $\mu\text{g mL}^{-1}$ were most effective only after 48 h incubation, the other time periods did not put noticeable effects on colon inhibition. When different fractions of PRE were tested against HCT-116, the water fraction (PREW) showed the highest antiproliferative activity as it inhibited more than 15% of colon. Thus the most effective extracts of *P. americana* were PRE and PREW, which were further studied for their effect on apoptosis inducing caspases. The activity of caspase 2 was non-significantly influenced by both extracts, while activity of other caspases: 3, 6, 8 and 9 was significantly influenced by both type and concentration of extracts. As the activity of caspase 6 was increased with an increase in PRE extract, while caspase 8's activity was only increased at 1600 $\mu\text{g mL}^{-1}$. In case of PREW the caspase 3 was positively influenced by 400 and 1600 $\mu\text{g mL}^{-1}$, while a non-significant decrease in its activity was observed at 800 $\mu\text{g mL}^{-1}$. Caspase 8 was more positively influenced by 800 $\mu\text{g mL}^{-1}$ than 1600 $\mu\text{g mL}^{-1}$ of PREW, while caspase 9 was equally and positively influenced by both these concentrations. Hence, the caspase activity was

dependant on the concentration and type of the extract. This differential response may be due to the difference in extracts active and dominant phytochemical. Thus this can be said that *P. americana* antiproliferative activity was highly influenced by the types of colon, caspase and extract. Moreover it was also influenced by extracts concentration and time of incubation.

Cancer is a serious health problem in both developed and developing countries and its treatment through anticancer drugs seem insufficient. The other resource of treatment; plants have ability to stop the growth of cancer and their study will help in organizing a reliable anticancer treatment. Maness *et al.* (2012) have identified anticancer property in plant name *P. americana*, who possess antiproliferative activity against colon cancer. It can also increase the activity of some apoptosis causing caspases, thus more scientific investigation of its efficiencies should carry out. This will help in establishing a proper treatment for cancer.

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