

## CARCINOGENIC AGENTS AND NON TRADITIONAL TREATMENT

BY

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### Abstract

Cancer is responsible for more than 10 million cases worldwide and the numbers are increasing. About 27% of patients undergo spontaneous regression (remission) and healing by unknown mechanism that is likely immunological by activation of natural killer cells. For centuries, herbs and plants have been used for medicinal purposes and as food as well.

**Key words:** Cancer, Non-traditional cure.

### Introduction

Common cancer types are bladder cancer, breast cancer, colon and rectal cancer, endometrial cancer, kidney cancer, leukemia, liver cancer, lung cancer, melanoma, non-Hodgkin lymphoma, pancreatic cancer, prostate cancer and thyroid cancer. The types of treatment that a patient receives depend on the type of cancer and how advanced it was.

Some people with cancer have only one treatment. But most people have a combination of treatments, such as surgery with chemotherapy and/or radiation therapy as traditional treatment. Also, there are immunotherapy to treat cancer, targeted therapy, hormone therapy, and stem cell transplant.

This mini-review discussed non-traditional treatment.

### Review and Discussion

Cancer risk factors are: diabetes mellitus, obesity, hepatitis C& B, alcoholism, any chronic irritation to an organ like skin by sun rays in predisposed fair skin patients causing skin cancer and as smoking is associated with cancer lungs in genetic susceptible patients (Hung *et al*, 2006). About 10% percent of cancer patients are familial that worth screening of family members. Human papillomavirus (HPV), Epstein-Barr virus (EBV), human T-cell lympho-tropic virus type 1 (HTLV-1), human herpes virus type 8 (HHV-8) and human immuno-deficiency virus type 1 (HIV-1) are predisposing agents (Bouvard *et al*, 2009). Blood flukes; *Schistosoma haematobium* and *S. mansoni* that cause schistosomiasis are endemic in many

countries especially in sub-Saharan Africa and Egypt (Abdel-Aal *et al*, 2015). *S. haematobium* leads to urinary bladder cancer (Honeycutt *et al*, 2014); adenocarcinoma and squamous cell carcinoma by chronic inflammation and oxidative stress due to parasite-derived molecules (Blanchard, 2004). *S. mansoni* causes adenocarcinoma type; colorectal cancer and hepato-cellular carcinoma, prostatic adenocarcinoma and sigmoid colonic cancer (Kiremit *et al*, 2015) via inflammation, oxidative stress also by parasite-derived molecules (Madbouly *et al*, 2007). *S. japonicum* causes schistosomiasis in Japan, Southeast Asia, and other countries leads to colorectal cancer and rectal cancer; squamous cell carcinoma, membranous nephropathy and metastatic lung cancer by inflammation and oxidative stress due to parasite-derived molecules (Gryseels *et al*, 2006). Liver flukes through eating undercooked fish and crabs are: *Opisthorchis viverrini* causing opisthorchiasis in southeast Asia leads to cholangio-carcinoma in 10% of infected cases (about 37 million asymptomatic cases) by inflammation, chronic irritation, and oxidative stress caused by parasite-derived molecules (Khuntikeo *et al*, 2016), cell proliferation with *Helicobacter pylori* mediated induction (IARC, 1994), Also, *Opisthorchis felinus* causing opisthorchiasis more in Europe and Russia (Pakharukova and Mordvinov, 2016). Moreover, *Clonorchis sinensis* causing clonorchiasis in China, Korea, Northern Vietnam, Saudi Arabia, Yemen and now in Egypt (Morsy and Al-Mathal, 2011).

*Strongyloides stercoralis*, an intestinal nematode, causes strongyloidiasis and gastrointestinal ulcer worldwide especially in tropical and subtropical regions (Segarra-Newnham, 2007). About 50% of chronically infected patients were asymptomatic, but symptomatic ones may suffer severe skin pathology, diarrhea, nausea, and abdominal discomfort, complicated by autoinfection resulting in a hyper-infection syndrome and is associated with sustained infection, high worm burden and high mortality (Seo *et al*, 2015). *S. stercoralis* hyperinfection was detected in part geographically associated with occurrence of HTLV-1 infections, in a large cohort of 5209 cancer patients strongyloidiasis was associated with an increased occurrence of cancers (Tanaka *et al*, 2016). Toxocarasis, a neglected socio-economically important zoonotic nematode that afflicts millions of the pediatric and adolescent populations worldwide, especially in impoverished communities (Morsy, 2020). Migrating larvae (VLM) was associated with increased leukocytosis, including generalized lymphadenopathy, endophthalmitis, granulomatous hepatitis, asthma, endomyocarditis (Carvalho and Rocha, 2011), eosinophilia (>30%) and bladder and liver malignancy (Kang *et al*, 2014).

*Plasmodia* species: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, & *P. knowlesi* causing malaria worldwide especially in sub-Saharan Africa (Saleh *et al*, 2019) and Southeast Asia aiding Burkitt lymphoma; indirect carcinogenicity (Asito *et al*, 2010) by expansion of the EBV-infected B cell population (Rockford *et al*, 2005), suppression of EBV-specific T-cell immunity, reactivation of EBV & AID-dependent genomic translocation (Molyneux *et al*, 2012). American *Trypanosoma cruzi* causing Chagas' disease in South and Central America leads to gastrointestinal cancer and uterine leiomyoma (Krementsov, 2009). Antibodies against *T. cruzi* lysate recognized various rat and human tumor cell types such as colon and human breast cancer cells and thus mediate tumor cell killing by antibody-dependent cellular cytotoxicity (Ubillos *et al*, 2016).

Nevertheless, many patients don't feel comfortable using traditional treatment in form of chemotherapy (Akiyama *et al*, 2018) and radiotherapy (Wang and Jin, 2015). The main disadvantage of chemotherapy is its lack of specificity-apart from affecting cancerous cells, also it damages the surrounding cells/tissue-that leads to development of multidrug resistance during the treatment, and limitations can go as far as recurrence (Zhao *et al*, 2018). Radiotherapy proved to be efficient when dealing with various cancers that are localized in specific body sites. This treatment also comes with several disadvantages varying from recurrence to morbidity (Narayana, 2014). Lungu *et al*. (2019) reported that disadvantages come with traditional cancer treatments, as chemotherapy and radiotherapy, generated studies shift to the nanotechnology. But, even with the important advancements regarding cancer therapy, there are still serious stepping stones that need to be addressed. The use of both nanotechnology and nano-medicine has generated significant improvements in nano-sized materials development and their use as therapeutic, diagnosis, and imaging agents. The biological barriers that come from the healthy body, as well from the tumorous sites, are important parameters to be taken into consideration when designing drug delivery systems. There are several aspects of extreme importance such as the tumor microenvironment and vasculature, the reticuloendothelial system, the blood-brain barrier, the blood-tumor barrier, and renal system. In order to achieve an effective system for cancer therapy, several characteristics of the nanoparticles have been outlined. They added that liposomes, polymeric, gold, and magnetic nanoparticles were tested as potential candidates for cancer treatments. These nanoparticles exhibit impressive properties such as versatility, functionality, biocompatibility, and other specific features. Great improvements were made so far for the use of nano-biomaterials in cancer therapy. However, there are still many challenges ahead,

and an advanced understanding of the biological features is needed in order to design systems with tailor-made properties.

No doubt, doctors usually don't tell patients about nontraditional methods but there are many success stories using it. This includes: food special alkaline diet and limiting sugar intake as the basics of cancer cell starvation theory concepts based on characters of cancer cells that are avid much for sugar and rapidly dividing after acidic diet prolonged intake. This theory proposed after noble prize winner "Howard Otto", a German scientist on 1899. Intensive alkaline diet should be undertaken and advised even for healthy individuals of at least 60 to 80% of total amount of food intake daily to avoid post prandial academia which manifest by generalized weakness, shortness of breath. To limit protein intake also as it is precancerous according to studies that linked it to breast and colon cancers.

Siew *et al.* (2019) in Singapore declared a new scientific evidence for traditional use of local medicinal plant; *Clausena lansium*, *Lea indica*, *Pereskia bleo*, *Strobilanthes crispus*, *Vernonia amygdalina* and *Vitex trifolia* in cancer treatment.

Avoid fast food intake: soda, processed meat, processed cheese, fries and fried chicken, totally avoid white sugar intake and microwave popcorn. Recommended alkaline food intake are green leafy vegetables, red bell peppers, onions, garlic, cruciferous vegetables as cabbages, broccoli, turnip, beet & broccoli sprouts, berries as strawberries and pomegranate are antioxidants, also apple cider vinegar, limes, olive oil are of benefit.

Almost 25% of drugs used during last two decades were directly derived from plants, while the other 25% are chemically altered natural products (Vuorelaa *et al.*, 2004). The thymoquinone derived from black seed (*Nigella sativa*) showed sustained inhibition of breast cancer cell proliferation with long-term treatment (Motaghd *et al.*, 2013).

Also, the herbals intake as: Moringa (miracle tree leaves extract), Tiloke *et al.* (2018)

gave the value of *Moringa oleifera* and its phytonanoparticles in natural medicine, synthesis of phytonanoparticles and the fundamental role as a potential antiproliferative agent against cancer. Besides, sweet worm wood (*Artemisia annua*) *Artemisia annua* possesses the capacity to produce high phenolic compounds resulted in high antioxidant activity. Five major groups (coumarins, flavones, flavonols, phenolic acids and miscellaneous) containing over 50 different phenolic compounds were identified analyzing *A. annua* (WHO, 2006). Ferreira *et al.* (2010) reported that artemisinin and its semi-synthetic analogs might become more effective to treat parasitic diseases (as malaria) and cancer if simultaneously delivered with flavonoids. Again as to Graviola (soursop, *Guanabana*) fruit and leaves extracts, Kim *et al.* (1998) in USA reported that Soursop is a healthy fruit. Peels form about 20% of the soursop fruit and are usually discarded as waste product. With a view to utilizing soursop peel as a source of valuable compounds, this study aimed to investigate the influence of different extraction conditions on total phenolic content and antioxidant capacity of soursop (*Annona muricata*) peel. By-products of soursop such as its peel could be an inexpensive source of good natural antioxidants with nutraceutical potential. Extracts from *Annona muricata* (also known as graviola) are among a myriad of botanical products which have shown promising medicinal value (Rady *et al.*, 2018). Ginger and curcumin in black pepper are strong antioxidants. Dehghani Nazhvani *et al.* (2020) evaluated the effects of different concentrations of four medicinal herbs including saffron, ginger, cinnamon and curcumin on oral squamous cell carcinoma (OSCC) cell line. The concluded that traditional medicinal herbs may potentially contribute to oral cancer treatment; providing new windows for the development of new therapeutic strategies for the OSCC. "You-you Toe" is a Chinese scientist who won Nobel Prize 2015 for discovery of the drug Artemisinin<sup>®</sup> (antimalarial drug)

extracted from sweet wormwood and she confirmed sweet wormwood efficacy as anticancer medication in presence of iron as studied on cancer lung cell line. Also, *Fountainea picrosperma*, commonly known as the blushwood tree, is a rainforest tree in the family Euphorbiaceae endemic to Queensland in Australia, and grows on Atherton Tablelands (McKeith, 2016).

Shareef *et al.* (2016) reviewed the biochemical properties of *Allium sativum*, *Echinacea*, *Curcuma longa*, *Arctium lappa*, *Camellia sinensis*, *Panax ginseng* and *Flax* seed. The extracts and juices of *Withania somnifera*, *Amoora rohituka*, *Dysoxylum binectariferum* and *Vaccinium macrocarpon*, respectively also used as anti-breast cancer. They added that volatile oils and extracts of these herbs and plants inhibited the synthesis of mevalonate that lessen the tumor growth and cholesterol synthesis.

Alkaline diet (Alice, 2010) should be intensified for cancer patients like also the Austrian Scientist diet recipe regimen when mixed in a blender in the form of beets 65%, celery, turnip, potatoes which healed thousands of patients according to their success stories. Alkaline water as "Zamzam" well water is beneficial being alkaline (Yazdi *et al.*, 2017). Ketogenic (high fat, low carb) diet is an alternative that benefited many patients (Schmidt *et al.*, 2011). Dietary given above are used for both prophylaxis and treatment of cancer.

Sodium bicarbonate 8.4% was given in an Italian polyclinic in high doses intravenously per protocol to cause starvation or cancer cells death with high selectivity, too, sparing normal cells (Zhang, 2017).

High doses of vitamin C of about 5 to 10 grams per day for 10 days are strongly recommended for its powerful anti-oxidant effect (Nomura *et al.*, 1991). Besides, vitamins D & E with intermittent fasting diet policy daily for 16 hours and limit food intake to one or two meals during the last 8 hours (Liang *et al.*, 2008). There are various mechanisms by which vitamin D influences the

natural history of cancer, including the role of vitamin D in the induction of apoptosis, stimulation of cell differentiation, anti-inflammatory and anti-proliferative effects and inhibition of angiogenesis, invasion and metastasis (de La Puente-Yagüe *et al.*, 2018).

Hyperbaric oxygen sessions and ozone therapy are adjuvants to complete the regimen. Clavo *et al.* (2018) in Spain reported that *in vitro* and animal studies, as well as isolated clinical reports, suggested the potential role of ozone as an adjuvant during radiotherapy and/or chemotherapy. But, further research, such as randomized clinical trials, is required to clarify its potential usefulness as an adjuvant therapeutic tool. Kirby (2019) in USA reported that the initial clinical uses of hyperbaric oxygen capitalized upon physical effects to drive offending gases back into solution and give more oxygen to tissues in early treatments of decompression sickness. HBO<sub>2</sub> has a myriad of other effects, including stimulating angiogenesis and new cellular in growth for healing. Aghajan *et al.* (2020) in USA reported that the hyperbaric oxygen therapy is safe and well-tolerated in pediatric and young adult patients with CNS tumors and clinical and radiographic improvements were observed in over half of patients.

### Conclusion

Listening to many success stories even healing with advanced stage 4 cancers by non-traditional treatment is encouraging the avoidance of psychiatric upset or depression, which usually bothers cancer patients. Further studies are advised to study the best regimen approach to cancer patients since it is still limited to apply non-traditional means and most if not all doctors don't talk to patients about it.

### References

- Abd El-Aal, AA, Bayoumy, IR, Basyoni, MM, Emran, AM, Abd El-Tawab, M.S, 2015: Genomic instability in complicated and uncomplicated Egyptian schistosomiasis *haematobium* patients. Mol. Cytogenet. 8, 1:1-8.
- Aghajan, Y, Grover, I, Gorski, H, Tumblin, M, Crawford, JR, *et al.*, 2019: Use of hyperbaric

- oxygen therapy in pediatric neuro-oncology: A single institutional experience. *J. Neurooncol.* 141, 1:151-8.
- Akiyama, Y, Kimura, Y, Enatsu, R, Mikami, T, Wanibuchi, M, et al, 2018:** Advantages & disadvantages of combined chemotherapy with carmustine wafer and bevacizumab in patients with newly diagnosed glioblastoma: A single-institutional experience. *World Neurosurg.* May; 113:e508-e514. doi: 10.1016/j.wneu. 2018.02.07 070.
- Alice, RD, 2010:** Another cancer and diet claim: The alkaline diet. American Institute for Cancer Research, USA.
- Asito, AS, Piriou, E, Odada, PS, Fiore, N, Middeldorp, JM, Long, C, 2010:** Elevated anti-Zta IgG levels and EBV viral load are associated with site of tumor presentation in endemic Burkitt's lymphoma patients: A case control study. *Infect. Agent Cancer* 5:13-8.
- Blanchard, TJ, 2004:** Schistosomiasis. *Travel Med. Infect. Dis.* 2:5-8.
- Bouvard, V, Baan, R, Straif, K, Grosse, Y, Secretan, B, et al, 2009:** A review of human carcinogens-part B: Biological agents. *Lancet Oncol.* 10, 4:321-2.
- Carvalho, EA, Rocha, RL, 2011:** Toxocariasis: Visceral larva migrans in children. *J. Pediatr. (Rio J).* 87, 2:100-10.
- Clavo, B, Santana-Rodríguez, N, Llontop, P, Gutiérrez, D, Suárez, G, et al, 2018:** Ozone therapy as adjuvant for cancer treatment: Is further research warranted? *Evid. Based Complement Alternat. Med.* 2018: 7931849. doi: 10.1155/2018/7931849
- Dehghani Nazhvani, A, Sarafraz, N, Askari, F, Heidari, F, Razmkhah, M, et al, 2020:** Anti-Cancer Effects of Traditional Medicinal Herbs on Oral Squamous Cell Carcinoma. *Asian Pac. J. Cancer Prev.* 21, 2:479-84.
- de La Puente-Yagüe, M, Cuadrado-Cenzual MA, Ciudad-Cabañas, MJ, Hernández-Cabría, M, Collado-Yurrita, L, 2018:** Vitamin D: And its role in breast cancer. *Kaohsiung J. Med. Sci.* 34, 8:423-7.
- Ferreira, JFS, Luthria, DI, Sasaki, T, Heyerick, A, 2010:** Flavonoids from *Artemisia annua* L. as antioxidants and their potential synergism with artemisinin against malaria and cancer. *Molecules* 15, 5:3135-70
- Gryseels, B, Polman, K, Clerinx, J, Kestens, L, 2006:** Human schistosomiasis. *Lancet* 368: 1106.
- Honeycutt, J, Hammam, O, Fu, CL, Hsieh, M H, 2014:** Controversies and challenges in research on urogenital schistosomiasis-associated bladder cancer. *Trends Parasitol.* 30, 7:324-32.
- Hung, RJ, Zhang, ZF, Rao, J, et al, 2006:** Protective effects of plasma carotenoids on the risk of bladder cancer. *J. Urol.* 176:1192-6.
- IARC, 1994:** Schistosomes, liver flukes and *Helicobacter pylori*: IARC working group on the evaluation of carcinogenic risks to humans. *IARC Monogr. Eval. Carcinog. Risks Hum.* 61:1-241.
- Kang, EJ, Choi, YJ, Kim, JS, Lee, BH, Kang, K, et al, 2014:** Bladder and liver involvement of visceral larva migrans may mimic malignancy. *Canc. Res. Treat.* 46, 4:419-24.
- Khuntikeo, N, Loilome, W, Thinkhamrop, B, Chamadol, N, Yongvanit, P, 2016:** A comprehensive public health conceptual framework and strategy to effectively combat cholangio-carcinoma in Thailand. *PLoS Negl. Trop. Dis.* 10, 1:23.
- Kim, GS, Zeng, L, Alali, F, Rogers, LL, Wu, FE, et al, 1998:** Two new mono-tetrahydrofuran ring acetogenins, anomuricin E and muricapentocin, from the leaves of *Annona muricata*. *J. Nat. Prod.* 61, 4:432-6.
- Kirby, JP, 2019:** Hyperbaric oxygen therapy and radiation-induced injuries. *Mo. Med.* 116, 3: 198-200.
- Kiremit, MC, Cakir, A, Arslan, F, Ormeci, T, Erkurt, B, et al, 2015:** The bladder carcinoma secondary to *Schistosoma mansoni* infection: A case report with review of the literature. *Int. J. Surg. Case Rept.* 13:76-8.
- Krementsov, N, 2009:** *Trypanosoma cruzi*, cancer and the cold war. *Hist. Cienc. Saude Mangueinhos.* 16, 1:S75-94.
- Liang, D, Lin, J, Grossman, HB, et al, 2008:** Plasma vitamins E & A and risk of bladder cancer: A case-control analysis. *Cancer Causes Control* 19:981-4.
- Lungu, II, Grumezescu, AM, Volceanov, A, Andronescu, E, et al, 2019:** Nanobiomaterials used in cancer therapy: An up-to-date overview. *Molecules* Sep 30;24(19). pii: E3547. doi: 10.3390/molecules24193547.
- Madbouly, KM, Senagore, AJ, Mukerjee, A, Hussien, AM, Shehata MA, et al, 2007:** Colorectal cancer in a population with endemic *Schistosoma mansoni*: Is this an at-risk population? *Int. J. Color. Dis.* 22, 2:175-81.
- McKeith, S, 2016:** Anti-cancer' berries discover

- red in Australian rainforest: A clinical trial is underway. [www.huffingtonpost.com](http://www.huffingtonpost.com). au
- Molyneux, EM, Rochford, R, Griffin, B, Newton, R, Jackson, G, et al, 2012:** Burkitt's lymphoma. *Lancet* 379, 9822:1234-44.
- Morsy, ATA, Al-Mathal, EM, 2011:** *Clonorchis sinensis*: A new report in Egyptian employees returning back from Saudi Arabia. *J. Egypt. Soc. Parasitol.* 41, 1:219-22
- Morsy, TA, 2020:** Toxocariasis: Visceral and ocular larva migrans. *J. Egypt. Soc. Parasitol.* 50, 1:41-8
- Motaghd, M, Al-Hassan, FM, Hamid, SS, 2013:** Cellular responses with thymoquinone treatment in human breast cancer cell line MCF-7. *Pharmacognosy Res.* 5, 3:200-6
- Narayana, A, 2014:** Applications of nanotechnology in cancer: A literature review of imaging and treatment. *J. Nucl. Med. Radiat. Ther.* 5 doi: 10.4172/2155-9619.1000195.
- Nomura, AM, Kolonel, LN, Hankin, J, Yoshizawa, C, 1991:** Dietary factors in cancer of the lower urinary tract. *Int. J. Cancer* 48:199-202.
- Pakharukova, MY, Mordvinov, VA, 2016:** The liver fluke *Opisthorchis felinus*: Biology, epidemiology and carcinogenic potential. *Trans. R. Soc. Trop. Med. Hyg.* 110, 1:28-36.
- Rady, I, Bloch, MB, Chamcheu, RCN, Mbeumi, SB, Anwar, MR, et al, 2018:** Anticancer properties of *Graviola (Annona muricata)*: A comprehensive mechanistic review. *Oxid. Med. Cell Longev.* 2018: 1826170. doi: 10.1155/2018/1826170
- Rockford, R, Cannon, MJ, Moormann, AM, 2005:** Endemic Burkitt's lymphoma: A polymicrobial disease? *Nat. Rev. Microbiol.* 3, 2:182-7.
- Saleh, AMA, El Nakib, MM, Malek, DMA, Morsy, TA, 2019:** Mini-review on malaria and human immunodeficiency virus in Sub-Saharan Africa. *J. Egypt. Soc. Parasitol.* 49, 1:61-72
- Schmidt, M, Pfetzer, N, Schwab, M, Strauss, I, Kämmerer, U, 2011:** Effects of a ketogenic diet on the quality of life in 16 patients with advanced cancer: A pilot trial. *Nutr. Metab. (Lond)*. 8: 54. doi: 10.1186/1743-7075-8-54
- Segarra-Newnham, M, 2007:** Manifestations, diagnosis, and treatment of *Strongyloides stercoralis* infection. *Ann. Pharmacother.* 41, 12:1992-2001.
- Seo, AN, Goo, YK, Chung, DI, Hong, Y, Kwon, O, et al, 2015:** Comorbid gastric adenocarcinoma and gastric and duodenal *Strongyloides stercoralis* infection: A case report. *Korean J. Parasitol.* 53, 1:95-9.
- Shareef, M, Ashraf, MA, Sarfraz, M, 2016:** Natural cures for breast cancer treatment. *Saudi Pharm. J.* 24, 3:233-40.
- Siew, YY, Yew, HC, Neo, SY, Seow, SV, Lew, SM, et al, 2019:** Evaluation of anti-proliferative activity of medicinal plants used in Asian Traditional Medicine to treat cancer. *J. Ethnopharmacol.* 235:75-7.
- Tanaka, T, Hirata, T, Parrott, G, Higashirakawa, M, Kinjo, T, et al, 2016:** Relationship among *Strongyloides stercoralis* infection, human T-cell lymphotropic virus type 1 infection, and cancer: A 24-year cohort inpatient study in Okinawa, Japan. *Am. J. Trop. Med. Hyg.* 94, 2: 365-70.
- Tiloke, C, Anand, K, Gengan, RM, Chuturgoon, AA, 2018:** *Moringa oleifera* and their phytonanoparticles: Potential antiproliferative agents against cancer. *Biomed. Pharmacother.* 108: 457-66.
- Ubillos, L, Freire, T, Berriel, E, Chiribao, M L, Chiale, C, et al, 2016:** *Trypanosoma cruzi* extracts elicit protective immune response against chemically induced colon and mammary cancers. *Int. J. Cancer* 138, 7:1719-31.
- Vuorelaa, P, Leinonen, M, Saikkuc, P, Tammela, P, Rauhada, JP, et al, 2004:** Natural products in the process of finding new drug candidates. *Curr Med Chem.* 11:1375-89.
- Wang, X, Jin, J, 2015:** Advantages and disadvantages of postoperative radiotherapy in locally advanced gastric cancer. *Zhonghua Wei Chang Wai Ke Za Zhi.* 18, 10:986-9.
- WHO, 2006:** WHO monograph on good agricultural and collection practices (GACP) for *Artemisia annua* L., Geneva.
- Yazdi, FH, Monfared, AS, Tashakkorian, H, Zadeh, AM, Borzoueisileh, S, 2017:** Radioprotective effect of Zamzam (alkaline) water: A cytogenetic study. *J. Environ. Radioactivity* 167: 166-9
- Zhang, H, 2017:** Will cancer cells be defeated by sodium bicarbonate? *China Life Sci. Mar;* 60 (3):326-328. doi: 10.1007/s11427-016-0373-3.
- Zhao, CY, Cheng, R, Yang, Z, Tian, ZM, 2018:** Nanotechnology for cancer therapy based on chemotherapy. *Molecules* 23:826. doi: 10.3390/molecules23040826.