Egypt. J. Chem. Environ. Health, 5 (2):25-36 (2019)
On line ISSN: 2536-9164.

Nutritional evaluation and protective effect of some medicinal plants on DNA and cytogencity

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ABSTRACT

Medicinal plants also called medicinal herbs have been discovered and used in traditional medicine practices since prehistoric times. Plants contains many of phytochemical compounds for functions including defense against anti-mutagenic or anti-carcinogenic effects. Medicinal plants such as (Ginger), (Curcuma)and (Rosmary) are have nutritive value and major source of medicines as play important role for treatment of many various diseases.

Ginger has a long history of medicinal use particularly as an anti-inflammatory agent for a wide variety of diseases such as arthritis. Suppression of inflammation in arthritis is attributed to suppression of pro-inflammatory cytokines and chemokine's produced by synoviocytes, chondrocytes and leukocytes

Dried Curcuma longa is the source of the spice turmeric the ingredient that gives curry powder its characteristic yellow color Current research has focused on Curcuma antioxidant, hepato-protective, anti-inflammatory, anti-carcinogenic, and antimicrobial properties in addition to its use in cardiovascular disease and gastrointestinal disorders.

Rosemary clearly is an herb with many benefits. Valued for its contributions in the kitchen, and prized by modern herbalists for its traditional healing powers. Rosemary is a powerful antioxidant and anti-inflammatory agent, and that it prevents carcinogens from binding to DNA, and stimulates liver detoxification of carcinogens.

INTRODUCTION

Natural dietary agents including fruits, vegetables and spices have drawn a great deal of attention from both the scientific community and the general public due to their various health promoting effects .(**Shukla and Singh, 2007**).

Zingiberaceae family have been widely used in dietary cuisines and in traditional oriental medications without any serious adverse reactions. Some phenolic substances present in Zingiberaceae plants generally possess strong anti-inflammatory and antoxidative properties and exert substantial anticarcinogenic and anti-mutagenic activities (**Lee and Surh, 1998).** Ginger (Zingiber officinale Rosc) has been used as a spice for over 2000 years and has been utilized frequently int aditional oriental medicine for the treatment of a wide range of diseases (**Badreldin et al, 2008).**
Dietary supplementation of ginger improved antioxidant status of rats liver and blood serum. **(Manju and Nalini, 2005)** The most important components in ginger responsible for their various pharmacological properties are the6-gingerol and its derivatives whereas the important components of turmeric are the curcuminoids

(**Badreldin *et al,* 2008)** .The rhizome powder of turmeric (*Curcuma longa* Linn),another member of the Zingiberaceae family, has been extensively used for imparting color and flavor to foods and also for the treatment of a variety of inflammatory conditions and other diseases. **(Deshpande *et al,* 1997).**
Curcumin is an active ingredient derived for rhizome of the plant .Curcuma longa has anticancer activity. Although curcumin possesses chemo preventive properties against several types of cancer, the molecular mechanisms by which it inhibits cell growth and induces apoptosis are not clearly understood. (**Shankar and Srivastava 2007).**

Rosemary, Rosmarinus officinalis is an ancient herb originally grown in the Mediterranean area. The heady herb has a pine-like scent and the part that is used – the leaves – look like pine tree needles. The Greeks and Romans both used the herb as a memory aid and citizens in the Middle Ages used it as a food preservative. **(Arlene Lengyel, 2009).**In Egypt rosemary was used to embalm the dead and sprigs were placed in tombs to symbolize the memory of the departed .In Greece, healers believed that rosemary could treat problems of the liver, circulation, and digestion. In ancient China the herb was considered effective for treating headaches and when applied to the scalp was thought to cure baldness.(**Leung and Foster 1996)** Nucleic acids are organic molecules even DNA which carries genetic information is subjected to various chemical reactions in cells. Alterations of the chemical structure of DNA which referred as DNA damage or DNA lesions induce mutations in the DNA sequences which lead to Carcino genesis and cell death unless they are restored by the repair systems in each organism. **(Iwai 2006**).

Nutritional value of some medicinal plants

1 -GINGER (Zingibel officinale)

Nigam et al., (2009) said that ginger (Zingiberofficinale Roscoe) amonocotyledonous herb is widely used as a herbal medicine given the presence of homologous phenolic ketones of which [6]-gingerol is the major one. The quantity of [6]-gingerol in the fresh ginger rhizome was found to be 104-965 microg/g in common varieties of ginger available in Indian market. **Bonnie (2010)** found that ginger is a good source of the minerals potassium, magnesium, copper, manganese, and vitamin B6, with no sugar and only 19 calories in one ounce. In dried ginger powder,water–9.4 gm, Protein–9.1gm, Fat–6.0gm, Total carbohydrate–70.8 gm, Food energy–374 kcal, Fibre–5.9 gm, ash–4.8 gm, iron–12 mg, magnesium–184 mg, Phosphorous- 148 mg, potassium-1342 mg, sodium-32 mg, zinc–5 mg. ***Subodh Kumar et al ., (2013)***In the fresh ginger rhizome, the gingerols were identified as themajor active components and [6] gingerol [5-hydroxy-1-(4-hydroxy-3-methoxy phenyl) decan-3-one is the most abundant constituent in the gingerol series. The powdered rhizome contains 3-6%fatty oil, 9% protein, 60-70% carbohydrates, 3-8%crude fiber. ***Aicha et al .,(2015)*** There are various products that can be obtained from ginger (Zingiberofficinale Roscoe) rhizomes, such as dried products being difficult to choose the best option for antioxidant purposes. In this study, three different dried forms of ginger rhizomes (freshly dried, dried and powder dried) were characterized in terms of chemical composition including individual profiles in sugars, organic acids, fatty acids, tocopherols, and antioxidants (phenolics and flavonoids). ***Kruger et al .,(2018)*** ginger, a streamlined quantitative biopro filing was developed for effect-directed analysis of 17 commercially available ginger and ginger-containing products via high-performance thin-layer chromatography (HPTLC-UV/Vis/FL bioassay). The samples were investigated concerning their active profile as radical scavengers, antimicrobials, estrogen-like activators and acetylcholinesterase/tyrosinase inhibitors. The [6]-gingerol and [6]-shogaol content of the different products ranged 0.2-7.4mg/g and 0.2-3.0mg/g, respectively.

2 -Curcuma longa (turmeric)

Awasthiand Dixit (2009) found that Hydro distillation of rhizomes and leaves of Curcuma longa resulted in the isolation of 0.36% and 0.53% of oils (w/v) respectively on a fresh weight basis. GC and GC-MS analysis resulted in the identification of 73 constituents in rhizomes comprising 95.2% of the oil, of which the major ones were ar-turmerone (31.7%), α-turmerone (12.9%), β-turmerone (12.0%) and (Z) β-ocimene (5.5%). In the oils, 75 constituents comprising 77.5% of the oils were identified, the major ones were α-phellantrene (9.1%), terpinolene (8.8%), 1,8-cinceole (7.3%), undecanol (7.1) and p-cymene (5.5%).***Singh et al., (2010*)** reported that fresh and dry rhizomes of turmeric (Curcuma longa Linn.) were analyzed by GC-MS. The major constituents were aromatic-turmerone (24.4%), alpha-turmerone (20.5%) and beta-turmerone (11.1%) in fresh rhizome and aromatic-turmerone (21.4%), alpha-santalene (7.2%) and aromatic-curcumene (6.6%) in dry rhizome oil. Results showed that alpha-turmerone, a major component in fresh rhizomes is only minor one in dry rhizomes. **Ikpeama, et al**., (**2014)** showed that the nutritional composition of turmeric and its antimicrobial properties proximate vitamin, mineral and phytochemical compositions of the turmeric were determined using standard methods. The results of the analysis shows that it contains 8.92 % moisture content, 2.85 % ash, 9.42 % crude protein, 4.60 % crude fibre.***Sanatombi (2017)*** Curcuma are gaining importance globally as one of the significant ingredients in food and traditional medicines. They are also considered as nutritionally rich food products since the plants are a rich source of starch, carbohydrates, proteins, fats, vitamins, and minerals.[9–13] Several reports concerning the phytoconstituents, essential oils, and pharmacological actions have been published earlier.

3- Rosemary (Rosmarinuso fficinalis)

Inoue (2005)indicated that rosemary herb is the perfect plant to have in your kitchen garden. This incredibly popular herb contain many noteworthy health benefiting phyto-nutrients, anti-oxidants and essential acids. The herb is exceptionally rich source of many B-complex group of vitamin, such as folic acid, pantothenic acid, pyridoxine, riboflavin. It is one of the herbs that are very rich in folates; providing

about 109 mcg per 100g (about 27% of RDA). Folates are important in DNA synthesis and when given during peri-conception period can help prevent neural tube defects in the new-born babies. ***Pintore et al ., (2009)*** studied that Rosmarinusofficinalis essential oil was separated into its hydrocarbon and oxygenated fractions. The major compounds in the hydrocarbon fraction were alpha-pinene (44.2%), camphene (24.5%), and limonene (11.7%), while in the oxygenated fraction they were 1,8-cineole (37.6%), camphor (16.5%), and bornyl acetate (21.4%). The hydrocarbon fraction was submitted to a hydro formylation process and the antioxidant activity of the product was screened by the DPPH and beta-carotene/linoleic acid tests. The hydroformylated fraction maintained the antioxidant activity of the whole oil. **Karim et al . (2013)** Rosmarinus officinalis are commonly used as source of antioxidant compounds for food conservation . extracts from rosemary rich in (phenolic acids such as rosmarinic and carnosic acid) and pharmaceutical products . The antioxidant and anti bacterial activities of the basic components of the essential oils of thyme (carvacrol and thymol) and rosemary (1,8-cineole, α-pinene and camphor.

Medicinal uses of Some medicinal plants

1- GINGER (Zingibel officinale):

Ramudu et al., (2011) demonstrated that an ethanolic extract of ginger could lower the blood glucose levels as well as improve activities of intra- and extra-mitochondrial enzymes in diabetic rats. Ginger extracts could be used as a nephro-protective supplement particularly to reverse diabetic-induced complications.***Oboh et al ., (2012***) investigated The inhibitory effect of ginger extracts on acetylcholinesterase activities and some perooxidants induced lipid peroxidation in rat's brain could be attributed to the presence of phytochemicals such as flavonoids, tannins, alkaloids and terpenoids. Therefore some possible mechanism by which ginger extracts exert anti-Alzheimer properties could be through the inhibition of acetylcholinesterase activities and prevention of lipid peroxidation in the brain. ***Aicha et al .,(2015***) indicate that the ginger form has significant influence in chemical and antioxidant parameters of the plant. Dried ginger (DG) proved to be the best choice. Overall this study could help the consumer in the selection of the most suitable option regarding antioxidant purposes.The *in vitro* antioxidant properties (free radicals scavenging activity reducing power and lipid peroxidation inhibition) of their methanolic extracts were also evaluated. **Aryaeian et al ., (2019)** investigate the effect of ginger supplementation on the expression of some immunity and inflammation intermediate genes in patients who suffer from Rheumatoid Arthritis (RA). Ginger can improve RA by decreasing disease manifestations via increasing FoxP3 genes expression and by decreasing RORγt and T-bet genes expression.**Sayed et al ., (2020)** body weight gain decreased significantly in groups that

received ginger water. In addition both total cholesterol and serum triacylglycerol were reduced in the groups that received ginger water.

2 -Curcuma longa (turmeric)*:*

Aggarwal . and Sung(2009)has shown that curcumin a yellow pigment in the spice turmeric (also called curry powder) has been used as a treatment for inflammatory diseases. curcumin mediates its anti-inflammatory effects through the down regulation of inflammatory transcription factors (such as nuclear factor kappaB) enzymes (such as cyclooxygenase 2 and 5 lipoxygenase) and cytokines (such as tumor necrosis factor interleukin 1 and interleukin 6***.Oyagbemi et al., (2009)*** indicated that curcumin [1, 7-bis (4-hydroxy-3-methoxyphenyl)-1, 6 heptadiene-3, 5-dione] is an orange-yellow component of turmeric Curcuma longa a spice often found in curry powder. It is known to have a variety of biologic and pharmacologic activities including anti-inflammatory, anti-oxidant, and anticarcinogenic potential.***Rivera et al ., (2009*****)*** indicted that curcumin has shown anti-inflammatory, anti-oxidant, antifungal, antibacterial and anticancer activities. The pharmacological properties of curcumin were reviewed recently and focused mainly on its anticancer properties. However, its beneficial activity on liver diseases (known centuries ago, and demonstrated recently utilizing animal models) has not being reviewed in depth until now.**Ikpeama, et al ., (2014)** nutrients found in turmeric do more than just prevent deficiency diseases. It has a high nutritional status that can be exploited. The curcumin contain vitamins or vitamin precursor which produces vitamin C, beta - carotene as well as polyphenol coupled with fatty acid and essential oil. Turmeric is a good source of spice compared with other spiceThe phytochemical results of the extract reveal that it contains 0.40 % flavenoid. Flavenoids exhibits a range of biological activities, one of which is their ability to scavenge for biological radicals and superoxide anions radicals and thus health promoting in action. Flavenoids also exhibits anti - inflammatory, antiangionic, anti - allergic effects, analgesic and antioxidant propertiess.**Sanatombi (2017**). The turmic have been shown to contain bioactive molecules that possess pharmacological properties like anti-inflammatory, antimicrobial, hypocholestraemic, antirheumatic, antiviral, antifibrotic, antivenomous, antihepatotoxic, antidiabetic, antinociceptive, anticancerous, and gastroprotective properties.they have been used for the treatment of enlarged liver, spleen, stomach ulcer, diabetes, cough, hepatic disorders, chest pain, skin diseases, boils, blood purifier, and rheumatism.

3 - Rosemary (Rosmarinuso fficinalis):

Lai et al., (2009) suggested that rosmanol might contribute to the potent anti-inflammatory effect of rosemary and may have potential to be developed into an effective anti-inflammatory agent. Rosmanol is a natural polyphenol from the herb rosemary (Rosmarinusofficinalis L.) with high antioxidant activity.***Cheng et al., (2011*****)*** shown that rosemary extracts play important roles in anti-inflammation, anti-tumor, and anti-proliferation in various in vitro and in vivo settings. The roles of

tumor suppression of rosemary have been attributed to the major components, including carnosic acid, carnosol, and rosmarinic acid, rosmanol, and ursolic acid.Rosemary (Rosmarinusofficinalis) a culinary spice and medicinal herb, has been widely used in European folk medicine to treat numerous ailments.

Ngo et al .,(2011) suggested that the different molecular targets modulated by rosemary and its active constituents are useful indicators of success in clinical cancer chemo-prevention trials. the anticancer potential of rosemary extract, carnosol, carnosic acid, ursolic acid, and The Rosemary belongs to the Lamiaceae and possesses a number of desirable technological properties. Most of the data found in the literature refers to the antioxidant, antimicrobial and anti-inflammatory potential of Rosemary, which is often related to the presence of rosmarinic acid and carnasol, among other polyphenols rosmarinic acid.**Andreia et al ., (2016)** the rosemary extracts include properties such as antioxidant,3 anti-inflammatory,4antimicrobial,5hepatoprotective,6 and antidiabetic.7 These medicinal attributes have been related to its high content in phenolic compounds, mainly caffeic acid derivatives such as rosmarinic acid, which is one of the major components found in the plant.

Effect of some medicinal plants on DNA and cytogencity.

***1 GINGER (Zingiber officinale)*:**

Yang et al., (2010) showed that lysosomal membrane stability was reduced after treatment by 6-gingerol (20-80muM) for 40min, mitochondrial membrane potential decreased after treatment for 50min, GSH and ROS levels were significantly increased after treatment for 60min. These suggest 6-gingerol induces genotoxicity probably by oxidative stress lysosomal and mitochondrial damage were observed in 6-gingerol-induced toxicity.***Lee et al ., (2011)*** suggest that Gingerol pretreatment protected against Aβ(25-35)-induced cytotoxicity and apoptotic cell death such as DNA fragmentation, disruption of mitochondrial membrane potential**.** [6]-gingerol exhibits preventive and/or therapeutic potential for the management of AD via augmentation of antioxidant capacity**.**

***Yang et al ., (2011*)** investigated that 6-gingerol significantly reduced the DNA strand breaks and micronuclei formation caused by PAT. The GSH depletion induced by PAT in HepG2 cells was also attenuated by 6-gingerol pretreatment. 6-gingerol has a strong protective ability against the genotoxicity caused by PAT and the antioxidant activity of 6-gingerol may play an important part in attenuating the genotoxicity of PAT.

2 -Curcuma longa(turmic):

Biswas et al., (2010) curcumin intervention reduced the DNA damage, retarded ROS generation and lipid peroxidation and raised the level of antioxidant activity. Thus curcumin may have some protective role against the DNA damage caused by arsenic. ***Lee et al., (2010***) indicate that curcuma has protective effects against CCl_4-induced

hepatotoxicity in rats via activities of antioxidant and phase II detoxifying enzymes, and through the activation of nuclear translocated Nrf2**.**

Nayak and Sashidhar (2010) Supplementation of curcumin in the diet normalized the altered activities of LDH and ALT. At molecular level curcumin significantly reduced AFB(1)-N(7)-guanine adduct (P<0.001) excretion in the urine DNA adduct (P<0.05) in the liver and albumin adduct (P<0.001) in the serum.

***Tiwari and Rao (2010*)** evaluated curcumin as a potential natural antioxidant to mitigate the genotoxic effects of arsenic (As) and fluoride (F) in human peripheral blood lymphocytes. curcumin efficiently ameliorates the toxic effect of As and F by reducing the frequency of structural aberrations (>60%), hypoploidy (>50%) and primary DNA damage

3 Rosemary (Rosmarinuso fficinalis):

Posadas et al.,(2009*)** suggest that rosemary supplement improved the oxidative stress status in old rats. Supplementing the diet of aged rats with SFE rosemary extract produced a decrease in antioxidant enzyme activity, lipid peroxidation and ROS levels that was significant for catalase activity in heart and brain. ***Zunino and Storms (2009) found that carnosol from the herb rosemary blocks the terminal apoptotic events induced by chemotherapeutic drugs and carnosol delayed DNA cleavage in the cells when combined with chemotherapeutic drugs. So suggested that increased dietary intake of carnosol may potentially decrease the effectiveness of some standard chemotherapy treatments used for leukemia. ***Furtado et al., (2010)*** investigated the ability of *Rosmarinic acid (RA)* to prevent chemically induced chromosome breakage or loss and primary DNA damage using the micronucleus and comet assays with V79 cells respectively.***Cheng et al., (2011)*** demonstrated that the rosmanol-induced apoptosis in COLO 205 cells is involvement of caspase activation and involving complicated regulation of both the mitochondrial apoptotic pathway and death receptor pathway. **Hanan (2012)** find out whether curcuma, ginger and rosemary protect CCl4-induced DNA damage, DNA fragmentation was examined by agarose gel electrophoresis. curcuma, ginger and rosemary prevent the toxin-induced smear formation suggesting that these substancesmay possessa protective power for the prevention of liver cells from CCl4-induced DNA damage and necrotic death

Conclusion : Feeding on Curcuma ,Ginger and Rosemary or adding to the diet are more effective as prevention of DNA damage and this may be act as a protective against chronic diseases such as liver, kidney, diabetes, immune system diseases and is the major agent for protection against cancer.**(Hanan 2012).**

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