

Review Article

The Use of Natural Compounds as Potential and Alternative Treatment for Cancers

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Introduction

According to the National Cancer Institute, a significant body of laboratory evidence demonstrates that antioxidants may slow or possibly prevent the development of cancer. Antioxidant activity may be beneficial as it neutralizes the destructive effects of free radicals. Using natural compounds through a healthy diet and supplements is not a substitute for regular medical care and the more scientifically established benefits of surgery, radiotherapy and chemotherapy, but it is worth considering as a complementary form of medicine [1,2].

The search for natural compounds effective against cancers is an exhaustive and ongoing effort. Natural compounds are not only serve as drug or template for drugs but in many instances had been a source of discovery of novel biology that provided better understanding of target and pathway involved in the diseases processes as well as involved in the majority of cancer-fighting drugs used today. Organisms from plants to fungi to bacteria to marine animals have been investigated for their potential antitumor properties [3].

There are natural compounds used for the treatment of cancer and over 60- 75% of drugs currently used to fight cancer are derived from them.

In addition, drugs derived from natural compounds work better for cancer patients than do drugs manufactured synthetically [2].

About 70% of the species likely to contain chemicals with anticancer properties are located in the world's rain forests, but only a fraction of these plants have been analyzed.

Several natural compounds are currently used in cancer treatment, in which the most significant examples are vica alkaloid, vinblastine and vincristine which are isolated from the Madagascar periwinkle (*Catharanthus roseus*). Although these compounds are mainly used for the treatment of diabetes, but they can also increase the cure rates of leukemia, Hodgkin's disease, lymphoma, advanced testicular cancer, breast and lung cancers. Another example of a highly active agent derived from a natural product is etoposide

Abstract

It has long been established that a diet rich in fresh fruits, vegetables, seeds, grains and legumes and antioxidants and other beneficial compounds may help prevent cancer. However diet is not a cure for cancer, but it may help prevent some cancers as well as heart disease and it can help the body overcome the effects of conventional treatments.

Keywords: Natural compounds; Treatment; Cancer

(epipodophyllotoxin), which is derived from the mandrake plant (*Podophyllum*) and is used in the treatment of lymphomas and bronchial cancers. On the other hand, taxane, paclitaxel (Taxol) also is another example in this field, which is initially isolated from the bark of the Pacific yew (*Taxus brevifolia* Nutt) and has an impressive anti-tumor activity against breast and ovarian cancers [4].

Additionally, among main important natural compounds that boost the immune system to recognize the cancer cells or even might restrict blood supplies to a tumor cells [3] are: ginger, astragalus (Chinese herb), bee propolis, burdock seed, curcumin (turmeric), flaxseed (linseed), garlic, mushroom, ginseng, lemonene, glutamine, melatonin, parthenolide, resveratrol (from red grape), carotenoids (pigments in vegetables), indole-3-carbinol, Vitamin D, emodin, Vitamin E, genistein (from red clover), proanthocyanides (from grape seed and pine bark), flavonoids (from tea family and berry family).

Ginger

Ginger is an herb with white or yellow flowers and dark green leaves and a thick root. The word ginger comes from the Latin name *Zingiber* which is derived from the Sanskrit word *Sringavera* (meaning the rhizomes look like deer's antlers). The term ginger itself only refers to *Zingiber officinale* (the English botanist William Roscoe (1753-1831) gave the plant this name), which belongs to the botanical family of the *Zingiberaceae*, and not to any related species. The closely related species are *Zingiber montanum* and *Zingiber zerumbet*. The common cooking ginger originated in tropical Asia (50% of worldwide ginger production is in India), but is now grown as a commercial crop for the ginger root in Latin America and Africa as well as South East Asia.

The underground stem is the active part used (rhizomes are knobby and fleshy, covered in ring-like scars) and important part for food and medicine. Although the rhizomes grow underground, they are swollen stems, not roots. This is why fresh ginger is often referred to as stem ginger [5].

Table 1: Chemical constituents of ginger oil.

No.	Chemical Constituents	%
1	Thujene	0.21
2	Pineane	2.28
3	Camphene	5.19
4	Sabinene	4.48
5	Pinene	0.61
6	Myrcene	2.11
7	Phellandrene	0.31
8	Limonene	4.59
9	Linalool Oxide	0.37
10	Linalool	1.3
11	Iso-borneol	1.3
12	Terpeneol	0.46
13	Neral	2.71
14	Geranial	3.21
15	Anethole	0.6
16	Tepenyl Acetate	0.26
17	Geranyl Acetate	0.75
18	Eduesmol	0.57
19	Dodecanal	1.18
20	Copaene	0.41
21	Caryophyllene	1.00
22	Thujopsene	0.77
23	Humullene	0.61
24	Ar.Curcumine	6.89
25	Zingiberene (zerumbone)	19.43
26	Bisabolene	6.32
27	Candinene	6.8
28	Sesquiphellandrene	9.08
29	Elemol	1.3
30	Nerolidol	0.31
31	Caryophyllene Oxide	0.28
32	Cedrene Epoxide	0.63
33	Cedral	0.07
34	T-Cadinol	0.61
35	Bulnesol	0.41

The origin of ginger

The plant is said to originate from India, China and Java, yet it is also native of Africa. It is now cultivated in great quantities in Jamaica, and the best types of root is from the West Indies. However African and Cochin ginger yield the most resin and volatile oil. It was most likely brought to Europe between the 10th and 15th century as a condiment and spice. Ginger root is widely used around the world as a spice or food additive [6]. However, Malaysia has more than 1200 ginger plant species in 53 genera.

The production trends of ginger

India is the 1st country in the world with over 30% production, followed by China (~20.5%), Indonesia (~12.7%), then Nepal

(~11.5%) and Nigeria (~10%).

The chemistry of the ginger

The characteristic odor and flavor of ginger is caused by a mixture of volatile oils (ginger oil) which are zingerone, shogaols and gingerols, that compose 1-3% of the weight of fresh ginger.

The constitution of fragrant essential oil are sesquiterpenoids with (-)-zingiberene as the main component, but smaller amounts of other sesquiterpenoids (β -sesquiphellandrene, bisabolene and farnesene) and a small monoterpene fraction (β - cineol, and citral) have also been identified. The presence of nonvolatile phenylpropanoid derived compounds (especially gingerols and shogaols) make the pungent taste of ginger [6].

Active components of ginger

Ginger oil considered as the most potential part of the plant that is obtained from the unpeeled or dried, ground up root (rhizome) of the herb (about 2-4% oil) by steam distillation (Table 1). However, pungent phenol compounds such as gingerols and shogaols are also considered as active components. The oil blends well with many other essential oils including lemon, cedarwood, lime, eucalyptus, frankincense, geranium, rosemary, sandalwood, patchouli, myrtle, bergamot, rosewood, neroli, orange and ylang-ylang (Figure 1). Additionally a mixture of honey and ginger together is well known worldwide for relieving of respiratory problems.

Ginger oil properties

Ginger oil can vary in color from pale yellow to a darker amber color and the viscosity also ranges from medium to watery. It has a strong-spicy smell, sharp, warm and with a hint of lemon and pepper, which smells of actual ginger. In addition, it has peculiar and pungent taste [5].

Safety information of ginger oil

Ginger using is a time-honored approach to strengthening the body and treating disease, however, it contains components that can trigger side effects and interact with other herbs, supplements, or medications. Thus, the herb should be taken with care and under the supervision of a health care provider qualified in the field of botanical medicine. Ginger can cause heartburn, bloating, gas, belching and nausea, especially if taken in powdered form. Unchewed fresh ginger



Figure 1: Ginger rhizome with ginger oil.

may result in intestinal blockage, and individuals who have had ulcers, inflammatory bowel disease or blocked intestines may react badly to large quantities of fresh ginger [7]. There are also suggestions that ginger may affect blood pressure, clotting, and heart rhythms. It is contraindicated in people suffering from gallstones as it promotes the production of bile. Although ginger oil is non-toxic and non-irritant (except when used in high concentration), but it is very strong and therefore it should be used carefully. In addition it is slightly phototoxic and the applied area should not be exposed to sunlight (cause photosensitivity and skin rash).

Therapeutic properties of ginger oil

It include analgesic, anti-emetic, antiseptic, antispasmodic, bactericidal, carminative, cephalic, expectorant, febrifuge, laxative, rubifacient, stimulant, stomachic and tonic.

Actions of ginger oil

1. Adjuvant (added to a mixture to aid the effect of the principal ingredient).
2. Appetizer (exciting the appetite).
3. Aromatic (having an agreeable odor).
4. Carminative (expelling gas from the intestine).
5. Diaphoretic (promoting perspiration).
6. Expectorant (promoting the discharge of mucus and secretions from the respiratory passages).
7. Rubifacient (local irritant that producing blisters, inflammation and reddening of the skin).
8. Sialagogue (stimulating the secretion of saliva).
9. Stimulant (exciting the physiological processes).
10. Warming, anti-chilling effect on the whole circulation.
11. Preservative (killing the harmful bacteria).

Ginger side effects

Generally, ginger appears to be safe and side effects associated with ginger are rare, but if taken in excessive doses, may cause mild heartburn, diarrhea and irritation of the mouth. Although side effects were not reported in most studies [8], but studies of treating of cancer patients reported ginger side effects and are gastrointestinal disturbance, sleepiness, restless, sedation and heartburn.

Finally, ginger may interact with surgical medications including anesthesia, arrhythmias, poor wound healing, bleeding, photosensitivity reaction, and prolonged sedation [9].

Chemical composition of fresh ginger oil

The essential oil has various chemical constituents including the following:

The health benefits of ginger root oil

The extracted oil from ginger is very precious for the wellbeing of mankind. In fact, due to the manifold advantages that ginger essential oil offers, it has become a popular choice of oils in Aromatherapy and the main benefits include the following [7].

1. **Stomach:** Ginger is often used for stomach upsets like indigestion, stomach ache, dyspepsia, colic, spasms, diarrhea, heat cramps, and flatulence.

2. **Food poisoning:** Antiseptic and carminative properties of ginger make it to be used for the treatment of food poisoning, as well as intestinal infections and bacterial dysentery.

3. **Nausea and vomiting:** It is effective against motion sickness, morning sickness, nausea, and vomiting especially in pregnant women.

4. **Heart:** It boosts and strengthens the heart. Some research has indicated that it reduces cholesterol level and incidences of heart strokes and prevents blood clotting with reducing blood sugar level.

5. **Respiratory:** Although it soothes sore throat and is a good expectorant, but it is also effective in various respiratory problems such as cold, cough, flu, asthma, bronchitis, sinusitis, and breathlessness.

6. **Inflammation and pain:** It is analgesic and reduces pain caused by muscle aches, arthritis, osteoarthritis, rheumatism, headache, and migraine. In the other hand, regular uses of ginger leads to reduction of prostaglandins which are the compounds associated with pain.

7. **Menstrual problems:** It is used for the treating of irregular and painful menstrual discharges.

8. **Malaria:** It is effective against yellow fever and malaria.

9. **Stress:** It relieves depression, mental stress, exhaustion, dizziness, restlessness and anxiety.

10. **Impotency:** It removes impotency and treats premature ejaculation.

11. **Kidney:** It is believed that ginger root juice is able to dissolve kidney stones.

12. **Hair:** Its juice is used for controlling dandruff.

13. **Cancer:** It is effective against most types of cancers through a self-destruction process (apoptosis), which including breast cancer, cervical cancer, ovarian cancer, liver cancer, and colon cancer.

14. **Ginger as antioxidant:** Ginger root extract was shown to have more than 50 antioxidants. It is significantly lower lipid peroxidation by maintaining the activities of the antioxidant enzymes (superoxide dismutase, catalase, and glutathione peroxidase) [10].

Types of ginger

1. **Jamaica (White African):** The root is a light-brown colour with short rhizome and is very pungent.

2. **Cochin:** It has a very short rhizome, coated red-grey colour.

3. **Sunti (from Java):** It has a small rhizome with good medical qualities.

4. Coated or uncoated is the trade term for peel on or skinned root.

5. Green ginger is the immature undried rhizome.

6. Ratoon is uncultivated ginger.
7. Black or White ginger is a commercial ginger which is peeled or unpeeled according to whether, for both types the ripened roots are used, after the plant has died down [11].

Available forms of ginger

Ginger products are made from fresh or dried ginger root, or from steam distillation of the oil in the root. The herb is available in extracts, tinctures, capsules, and oils. Fresh ginger root can also be purchased and prepared as a tea (ginger tea).

Dosage and preparation of ginger

Generally, ginger intake should not exceed 4grams daily and usually food sources (ginger ale, ginger snaps, and ginger bread) not containing more than 0.5% ginger. Standardized dose is taking 75-2000 mg in divided doses with food that containing 4% volatile oils or 5% total pungent compounds). Thus, ginger preparation forms are as following:

1. **Infusion:** pour a cup of boiling water onto 1 teaspoonful of the fresh root and let it infuse for 5minutes.
2. **Decoction:** put 1.5 teaspoonfuls of the fresh root onto a cup of water, bring to boil and simmer for 5-10 minutes.
3. **Tincture:** weak tincture should be taken in a dose of 1.5-3 ml three times a day, while the strong one should be taken in a dose of 0.25-0.5 ml three times a day.

Thus, according to studies conducted by the World Health Organization (WHO), about 80% of the world's population in developing countries relies on traditional, complementary and alternative medicine, and today about 121 drugs prescribed in US come from natural sources in which 90 are derived either directly or indirectly from natural sources especially plants and about 47% of currently available anti-cancer drugs in the market come from natural products or natural product mimics [12].

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