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"Antioxidant in Daily Diet"

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ABSTRACT:- Antioxidants are an inhibitor of the process of oxidation, even at relatively small concentration and thus have diverse physiological role in the body. **Antioxidant** constituents of the plant material act as radical scavengers, and helps in converting the radicals to less reactive species.
Antioxidants are an inhibitor of the process of oxidation, even at relatively small concentration and thus have diverse physiological role in the body. Antioxidant constituents of the plant material act as radical scavengers, and helps in converting the radicals to less reactive species. A variety of free radical scavenging antioxidants is found in dietary sources like fruits,vegetables
and tea, etc. This review presents some information about the antioxidant / antiradicals and their role in our body and also their presence in spices and herbs.

Keywords: Antioxidants, Scavengers, Antiradicals, Zeaxanthin, Hemorrhagic, oxidizable, Alzheimers Disease, Monocotyledon, UnbleachedJamaica, Endodermis, Collateral

I. INTRODUCTION :-

Antioxidants are man-made or natural substances that may prevent or delay some types of cell damage. Diets high in vegetables and fruits, which are good sources of **antioxidants**, have been found to be healthy; however, research has not shown **antioxidant** supplements to be beneficial in preventing diseases.

Examples of antioxidants include **vitamins C and E, selenium, and carotenoids, such as beta-carotene, lycopene, lutein, and zeaxanthin**. This fact sheet provides basic information about antioxidants, summarizes what the science says about antioxidants and health, and suggests sources for additional information.
Vegetables and fruits are rich sources of antioxidants. There is good evidence that eating a diet that includes plenty of vegetables and fruits is healthy, and official U.S. Government policy urges people to eat more of these foods. Research has shown that people who eat more vegetables and fruits have lower risks of several diseases; however, it is not clear whether these results are related to the amount of antioxidants in vegetables and fruits, to other components of these foods, to other factors in people's diets, or to other lifestyle choices.

- Rigorous scientific studies involving more than 100,000 people combined have tested whether antioxidant supplements can help prevent chronic diseases, such as cardiovascular diseases, cancer, and cataracts. In most instances, antioxidants did not reduce the risks of developing these diseases.
- Concerns have not been raised about the safety of antioxidants in food. However, high-dose supplements of antioxidants may be linked to health risks in some cases. Supplementing with high doses of beta-carotene may **increase** the risk of lung cancer in smokers. Supplementing with high doses of vitamin E may **increase** risks of prostate cancer and one type of stroke.
- Antioxidant supplements may interact with some medicines.
- Tell all of your health care providers about any complementary and integrative health approaches you use. Give them a full picture of what you do to manage your health. This will help ensure coordinated and safe care.
- High-dose antioxidant supplements may be harmful in some cases. For example, the results of some studies have linked the use of high-dose beta-carotene supplements to an increased risk of lung cancer in smokers and use of high-dose vitamin E supplements to increased risks of hemorrhagic stroke (a type of stroke caused by bleeding in the brain) and prostate cancer.
- Like some other dietary supplements, antioxidant supplements may interact with certain medications. For example, vitamin E

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supplements may increase the risk of bleeding in people who are taking anticoagulant drugs ("blood thinners"). There is conflicting evidence on the effects of taking antioxidant supplements during cancer treatment; some studies suggest that this may be beneficial, but others suggest that it may be harmful. The National Cancer Institute recommends that people who are being treated for cancer talk with their health care provider before taking supplements.

Antioxidants are a group of substances which, when present at low concentrations, in relation to oxidizable substrates, significantly inhibit or delay oxidative processes, while often being oxidized themselves.

II. DEFINITION :-

A substance that inhibits oxidation, especially one used to counteract the deterioration of stored food products.

Oxidation is a chemical reaction that can produce free radicals, thereby leading to chain reactions that may damage the cells of organisms. Antioxidants such as thiols or ascorbic acid terminate these chain reactions.

III. USE OF ANTIOXIDANT IN DAILY DIET:-

- Antioxidants are substances that may protect your cells against free radicals, which may play a role in **heart disease**, **cancer** and other diseases. Free radicals are molecules produced when your body breaks down food or when you're exposed to tobacco smoke or radiation.
- Antioxidants are substances that may protect your cells against free radicals, which may play a role in heart disease, cancer and other diseases. Free radicals are molecules produced when your body breaks down food or when you're exposed to tobacco smoke or radiation.
- Antioxidants, such as vitamins C and E and carotenoids, may help protect cells from damage caused by free radicals. Other naturally occurring antioxidants include flavonoids, tannins, phenols and lignans. Plant-based foods are the best sources. These include fruits, vegetables, whole grains, nuts, seeds, herbs and spices, and even cocoa.
- As a bonus, fruits, vegetables and whole grains high in antioxidants are also typically high in fiber, low in saturated fat and cholesterol, and good sources of vitamins and minerals. So enjoy the variety.
- Blueberries, blackberries, raspberries, strawberries and cranberries are among the top fruit sources of antioxidants.
- Sweet potatoes, carrots, red and green peppers, kale, spinach, and broccoli all contain the antioxidant carotene. Try to choose red, orange, deep yellow and dark green leafy vegetables every day.
- Walnuts and pecans are some of the top nuts for antioxidant content. Not crazy about nuts? Try sunflower seeds.
- Toast your health with antioxidant-rich fruit juices, such as pomegranate juice, or a glass of red wine. Even coffee and tea have antioxidants. while you're celebrating, enjoy a nibble of dark chocolate for another antioxidant boost. Remember, when it comes to adding antioxidants to your diet, no one food or food group should be your sole focus. Instead, be sure to incorporate a variety of fruits, vegetables, nuts and whole grains in your diet.

IV. CLASSIFICATION OF ANTIOXIDANTS :-

Antioxidants can be classified into two major types based on their source, i.e., **natural** and **synthetic antioxidants.**

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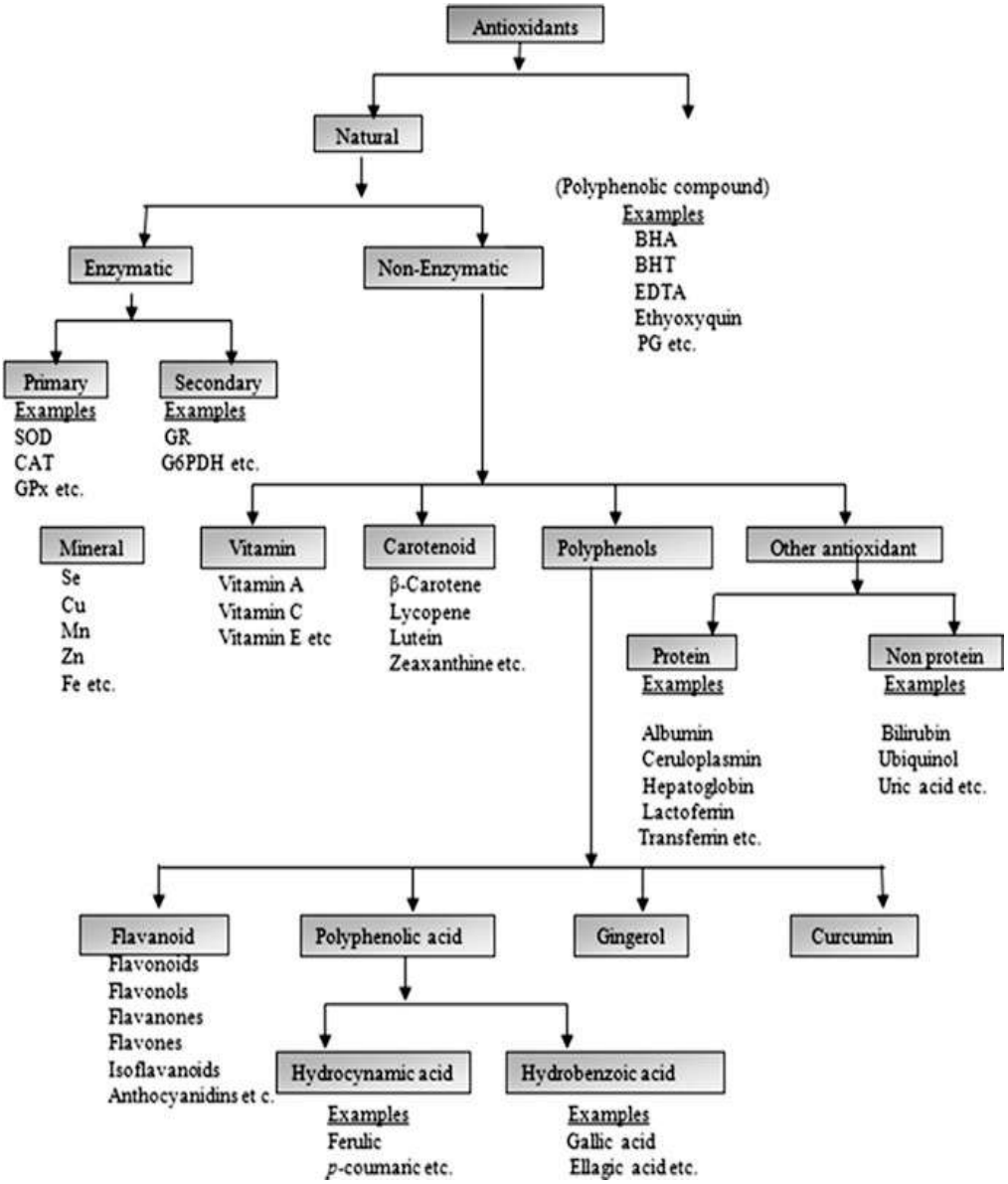
Fig. Classification of Antioxidants



Natural Antioxidants

Natural antioxidants either are synthesized in human body through metabolic process or are supplemented from other natural sources, and their activity very much depends upon their physical and chemical properties and mechanism of action. This can be further divided into two categories, i.e., enzymatic antioxidants and non enzymatic antioxidants.

Enzymatic Antioxidants

Enzymatic antioxidants are uniquely produced in the human body and can be subdivided into primary and secondary antioxidant.

Primary Antioxidants

Primary antioxidants mainly include superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) as described below. Superoxide Dismutase Superoxide dismutase (SOD) enzyme is found in both the dermis and the epidermis. It removes the superoxide radical (O2.−) and repairs the body cells damaged by free radical. SOD catalyzes the reduction of superoxide anions to hydrogen peroxide. SOD is also known to compete with nitric oxide (NO) for superoxide

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anion, which inactivates NO to form peroxynitrite. Therefore, by scavenging superoxide anions, it promotes the activity of NO.

Catalase Catalase enzyme (CAT) is found in the blood and most of the living cells and decomposes H2O2 into water and oxygen. Catalase along with glucose peroxidase is also used commercially for the preservation of the fruit juices, cream consisting of egg yolk, and salad by removing the oxygen.

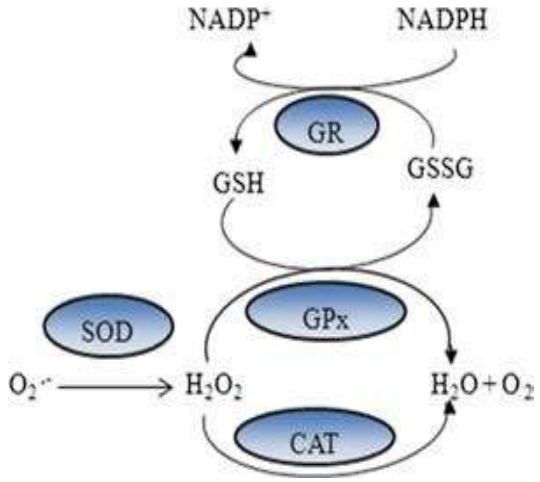

Fig. Outline of the mechanism of enzymatic antioxidants in the removal of free radical

Glutathione Peroxidase Glutathione peroxidase (GPx) is a group of selenium dependent enzymes, and it consists of cytosolic, plasma, phospholipid hydroperoxide, and gastrointestinal glutathione peroxidase. GPx (cellular and plasma) catalyzes the reaction of H2O2 by reduced glutathione (GSH); as a result, oxidized glutathione (GSSG) is produced and it is again recycled to its reduced form by glutathione reductase (GR) and reduced nicotinamide adenine dinucleotide phosphate (NADPH).

Secondary Antioxidant

Secondary antioxidant includes glutathione reductase (GR) and glucose-6-phosphate dehydrogenase (G6PDH). G6PDH generates Glutathione Peroxidase Glutathione peroxidase (GPx) is a group of selenium dependent enzymes, and it consists of cytosolic, plasma, phospholipid hydroperoxide, and gastrointestinal glutathione peroxidase. GPx (cellular and plasma) catalyzes the reaction of H2O2 by reduced glutathione (GSH); as a result, oxidized glutathione (GSSG) is produced and it is again recycled to its reduced form by glutathione reductase (GR) and reduced nicotinamide adenine dinucleotide phosphate (NADPH).

Secondary Antioxidant

Secondary antioxidant includes glutathione reductase (GR) and glucose-6-phosphate dehydrogenase (G6PDH). G6PDH generates protein in the biological system. Normally the concentration of free iron is very low and the low concentrations of iron-binding proteins promote ROS production, lipid peroxidation, and oxidative stress. Hence iron supplementation helps in reducing the oxidative stress. Magnesium (Mg) Magnesium is a cofactor for glucose-6-phosphate dehydrogenase (G6PD) and 6-phosphogluconate dehydrogenase (6PGD) involved in pentose cycle which catalyzes the production of NADPH from NADP during the glucose metabolism and hence maintains the normal ratio of GSH to GSSG and a normal redox state in cells. Deficiency of magnesium reduces GR activity and GSSG does not reduce to GSH, hence causing oxidative damage to the cells.

Selenium (Se) Selenium is also a very important component of enzymatic antioxidant. In the presence of selenium (Se), glutathione peroxidase (GPx) plays a protective role against oxidation of lipid and protects the cell membrane and takes part in H2O2 and lipids' hydroxyl peroxide metabolism. Hence, Se behaves like vitamin E and can be substituted in place of vitamin E and is used to prevent the risk of cancer and cardiovascular diseases.

Copper (Cu), Zinc (Zn), and Manganese (Mn) SOD is a class of enzyme that consists of different types of SODs, depending upon their metal cofactor such as Cu–Zn and Mn. Cu–Zn SOD is found in the cytosol having Cu and Zn at their active sites which helps in proton conduction, whereas Mn-SOD is found in mitochondria and has Mn at its active site. These metals are responsible for SOD's antioxidant activities.

Vitamins

Vitamins form the class of micronutrients required for the proper functioning of the body's antioxidant enzyme system, such as vitamin A, vitamin C, vitamin E, and vitamin B. They cannot be synthesized in our body and hence need to be supplemented in the diet.

Vitamin A is helpful in night vision and in maintenance of epithelial cells in mucus membranes and skin. Because of its antioxidant properties, it assists immune system also and is found in three main forms: retinol, 3, 4-

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didehydroretinol, and 3-hydroxyretinol. The main sources of this include sweet potatoes, carrots, milk, egg yolks, and mozzarella cheese.

Vitamin C is water soluble and is also called as ascorbic acid. It is found in fruits (mainly citrus), vegetables, cereals, beef, poultry, fish, etc. It is helpful in preventing some of the DNA damage caused by free radicals, which may contribute to the aging process and the development of diseases, such as cancer, heart disease, and arthritis.

Vitamin E is a lipid-soluble vitamin. This consists of eight different forms such as α-, β-, γ-, and δ-tocopherol and α-, β-, γ-, and δ-tocotrienol.

Most abundantly found in almonds, safflower oil, soybean oils, oil of wheat germs, nuts, broccoli, fish oil, etc., α-tocopherol possesses highest bioavailability and is the most important lipid-soluble antioxidant which reacts with the lipid radical and protects the membranes from lipid peroxidation; as a result, oxidized α-tocopheroxyl radicals are produced that can be recycled to the reduced form through reduction by other antioxidants, such as ascorbate and retinol.

Carotenoid

Carotenoid consists of β-carotene, lycopene, lutein, and zeaxanthin. They are fat-soluble colored compounds found in fruits and vegetables. β- Carotene is found mostly in radish-orange-green color food items including carrots, sweet potatoes, apricots, pumpkin, mangoes, and cantaloupe along with some green and leafy vegetables, including collard greens, spinach, and kale. Lutein is abundant in green leafy vegetables such as collard greens, spinach, and kale. Lutein is best known for its role in protection of retina against harmful action of free radicals and also prevents atherosclerosis. Although lycopene, lutein, canthaxanthin, and zeaxanthin do not possess provitamin A activity, β-carotene is known as a precursor for vitamin A. Tomato is a good source of lycopene and spinach is a good source of zeaxanthin. It has been shown that lycopene is a potent antioxidant and is the most effective compound in removing singlet oxygen found in tomatoes, watermelon, guava, papaya, apricots, pink grapefruit, and other foods.

Polyphenols

Polyphenols is a class of the phytochemicals that possess marked antioxidant activities. Their antioxidant activities depend on their chemical and physical properties which in turn regulates the metabolism depending on their molecular structures. These consist of phenolic acids, flavonoids, gingerol, curcumin, etc.

Flavonoid is a major class of polyphenolic compound and is mostly found in vegetables, fruits, grains, seeds, leaves, flower, bark, etc. Some of the spices, such as ginger and turmeric, are also good sources of polyphenolic compound, e.g., gingerol is obtained from the rhizomes of ginger, whereas curcumin (diferuloylmethane) is the main bioactive component of turmeric and is known to possess good antioxidant activity.

Other Antioxidants

Transition Metal-Binding Proteins Albumin, ceruloplasmin, hepatoglobin, and transferrin are the transition metal-binding proteins found in human plasma, bind with transition metals, and control the production of metal catalyzed free radicals.

Albumin and ceruloplasmin are the copper ion sequesters, hepatoglobin is hemoglobin sequester, and transferrin acts as free iron sequester.

Nonprotein Antioxidants Bilirubin, uric acids, and ubiquinol are nonprotein antioxidants which inhibit the oxidation processes by scavenging free radicals. Bilirubin is an end product of heme catabolism. It is a lipid-soluble cytotoxic product that needs to be excreted. However, bilirubin efficiently scavenges peroxyl radical at micro molar concentrations in in vitro model and is regarded as the best antioxidant against lipid peroxidation.

Uric acid is a powerful antioxidant and is a scavenger of singlet oxygen and radicals. Urate reduces the oxo-heme oxidant formed by peroxide reaction with hemoglobin and protects erythrocytes from peroxidative damage. The plasma urate levels in humans are about 300 μm, making it one of the major antioxidants in humans.

Coenzyme Q is also known as ubiquinol (Co Q) and is an oil-soluble antioxidant. This is produced in the body through monovalent pathway, in heart, liver, kidney, pancreas, etc. The mechanism of the action may occur in two ways: In the first mechanism, reduced form of ubiquinol (CoQH) acts as chain-breaking antioxidant and reduces peroxyl (ROO.) and alcoxyl radicals (LO.) In the second mechanism, it reacts with vitamin E radical (TO.) and regenerating vitamin E.

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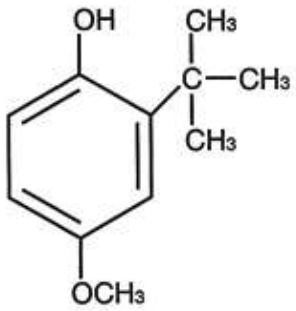
Synthetic Antioxidants

Synthetic antioxidants are artificially produced or synthesized using various techniques. Basically they are polyphenolic compounds mainly that capture the free radicals and stop the chain reactions. Polyphenolic derivatives usually contain more than one hydroxyl or methoxy group. Ethoxy quinine is the only heterocyclic, N-containing compound reported to be used as antioxidant in the food, especially animal feed. Mostly reported synthetic phenolic antioxidants are p-substituted, whereas the natural phenolic compounds are mostly o-substituted. The p-substituted substances are preferred because of their lower toxicity. Synthetic phenolic antioxidants are always substituted with alkyl groups to improve their solubility in fats and oils and to reduce their toxicity. These synthetic compounds possessing antioxidant activity are commonly used in pharmaceuticals, as preservatives for cosmetics and to stabilize the fat, oil, and lipid in food.

These new findings about the synthetic antioxidants have led the researches to develop new synthetic antioxidants in terms of their water solubility, stability, and non-toxicity. Characteristics of some of the known synthetic antioxidants, such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), ethylene diamine tetra acetic acid (EDTA), 6- ethoxy-1,2 dihydro-2,2,4-trimethylquinoline (ethoxyquin), propyl gallate (PG), and tertiary butylhydroquinone (TBHQ), are given below (structures of these antioxidants are shown in Fig.).

BHA

It is a monophenolic, lipid-soluble antioxidant, better used for the lipid oxidation in animal fat compared to vegetable oil



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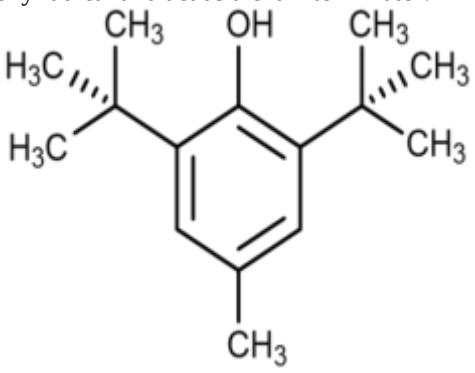
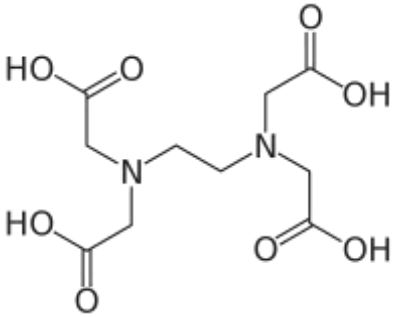
BHT

It is also a monophenolic fat-soluble antioxidant but is more stable than BHA at high temperature, and both act synergistically. Many commercially available antioxidant formulations contain both of these antioxidants. BHA interacts with peroxy radicals to produce a BHA phenoxy radical which in turn may remove a hydrogen atom from the hydroxyl group of BHT. BHA is regenerated by the hydrogen radical provided by BHT. The BHT radicals so formed can react with a peroxy radical and act as a chain terminator.



EDTA

EDTA is a common sequestrant, water-soluble antioxidant added to foods, body care, and household products. It binds with trace minerals, such as copper, iron, and nickel that may be present in the food product. If not inactivated, these minerals may lead to discoloration, rancidity, and textural breakdown. When added as an antioxidant, EDTA prevents oxygen from causing color changes and rancidity.



Ethoxyquin

It is as an antioxidant primarily used to protect carotenoid oxidation in animal feeds, vegetables (potato etc.), and fruits (apples and pears) during storage.

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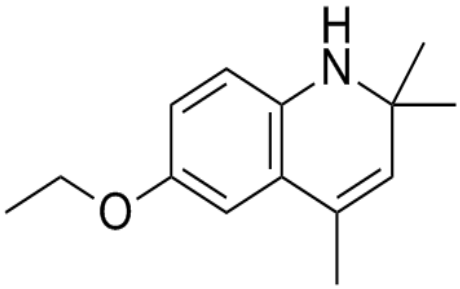
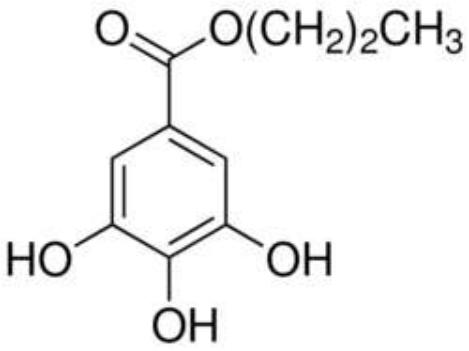


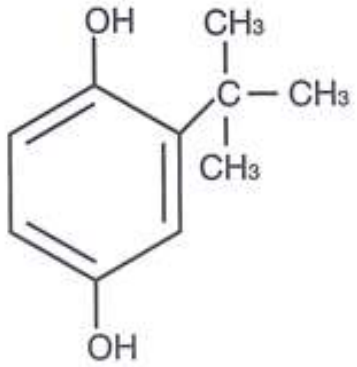
PG

It is an ester formed by the condensation of gallic acid and propanol. It acts as an antioxidant which is used as a food additive to protect mainly oils and fat in the food products.



TBHQ

TBHQ is a highly effective diphenolic antioxidant. In foods, it is used as a preservative for unsaturated vegetable oils and many edible animal fats. It does not cause discoloration even in the presence of iron and does not even change flavor or odor of the material to which it is added. It is used industrially as a stabilizer to inhibit auto-polymerization of organic peroxides. It is also used as a corrosion inhibitor in biodiesel. In perfumery, it is used as a fixative to lower the evaporation rate and improves stability. It is also added to varnishes, lacquers, resins, and oilfield additives. It can be used alone or in combination with BHA or BHT



V. ANTIOXIDENTS USED IN DAILY DIET :-

I. GARLIC :-

Latin Name :- Allium sativum
Family :- Amaryllidaceae
Biological Source
Garlic is the ripe bulb of Allium sativum Linn., belonging to family Liliaceae.
Geographical Source
Garlic occurs in central Asia, southern Europe, and United States. It is widely cultivated in India.

Cultivation and Collection

The cultivation of Garlic is similar to that of onion. It is generally grown as an irrigated crop throughout the year. It can be grown under a wide range of climatic conditions but it succeeds best in mild climates without extremes of heat and cold. It is grown on a wide variety of soils. It requires a rich well-drained clay loam to grow well. The land is well ploughed to a fine tilth, beds, and channels are made. Garlic is planted during October–November in plains and during February–March in the hills. The cloves are separated and pressed lightly into the soil. Garlic requires heavy manuring.

Characteristics
It is a perennial herb having bulbs with several cloves, enclosed in a silky white or pink membraneous envelope.

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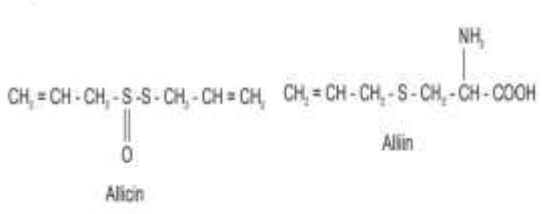
Allium sativum

Chemical Constituents

Allicin, a yellow liquid responsible for the odour of garlic, is the active principle of the drug. It is miscible with alcohol, ether, and benzene and decomposes on distilling. The other constituents reported in Garlic are alliin, volatile and fatty oils, mucilage and albumin. Alliin, another active principle, is odourless, crystallized from water acetone and practically insoluble in absolute alcohol, chloroform, acetone, ether, and benzene. Upon cleavage by the specific enzyme alliinase, an odour of garlic develops, and the fission products show antibacterial action similar to allicin. Essential oil (0.06–0.1%) contains allyl propyl disulphide, diallyl disulphide, and allicin. γ-Glutamyl peptides are isolated from the Garlic. The amino acids present in the bulb are leucine, methionine, S-propyl-L-cysteine, S-propenyl-L-cysteine, S-methyl cysteine, S-allyl cysteine sulphoxide (alliin), S-ethyl cysteine sulphoxide, and S-butyl-cysteine sulphoxide.



Antioxidant factor :- allyl cysteine, allin, allicin, allyl.

Garlic is a good source of antioxidant which is **allium sulphur compound.**

Garlic and garlic extracts, through their antioxidant activities, have been reported to provide protection against free radical damage in the body.

This study investigated antioxidant properties of garlic compounds representing the four main chemical classes, alliin, allyl cysteine, allyl disulfide, and allicin, prepared by chemical synthesis or purification. Alliin scavenged superoxide, while allyl cysteine and allyl disulfide did not react with superoxide

Allicin suppressed the formation of superoxide by the xanthine/xanthine oxidase system, probably via a thiol exchange mechanism.

Alliin, allicin, and allyl cysteine did not prevent induced microsomal lipid peroxidation, but both alliin and allyl cysteine were hydroxyl scavengers, and allyl disulfide was a lipid peroxidation terminator.

Fig. Garlic

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Uses of Garlic :-

- Garlic has played an important dietary and medicinal role throughout the history of mankind.
- In some Western countries, the sale of garlic preparations ranks with those of leading prescription drugs.
- The therapeutic efficacy of garlic encompasses a wide variety of ailments, including cardiovascular, cancer, hepatic and microbial infections to name but a few.
- Garlic Contains Antioxidants That May Help Prevent Alzheimer's Disease and Dementia

1. Oxidative damage from free radicals contributes to the aging process.
2. Garlic contains antioxidants that support the body's protective mechanisms against oxidative damage.
3. High doses of garlic supplements have been shown to increase antioxidant enzymes in humans, as well as significantly reduce oxidative stress in those with high blood pressure.
4. The combined effects on reducing cholesterol and blood pressure, as well as the antioxidant properties, may reduce the risk of common brain diseases like Alzheimer's disease and dementia.

- Athletic Performance Might Be Improved With Garlic Supplements.

Eating Garlic May Help Detoxify Heavy Metals in the Body.

II. ONION :-

Latin name :- Allium cepa
Family :- Amaryllidaceae

Biological sources :

Allium cepa, (**onion**) a monocotyledon is one of the oldest graminan-type fructan-containing vegetables. Its wild varieties are thought to originate from Central Asia near Iran. **Onion** bulbs have been used as a food **source** for millennia.

Cultivation :

Onions are best cultivated in fertile soils that are well-drained. Sandy loams are good as they are low in sulphur, while clayey soils usually have a high sulphur content and produce pungent bulbs. Onions require a high level of nutrients in the soil. Phosphorus is often present in sufficient quantities, but may be applied before planting because of its low level of availability in cold soils. Nitrogen and potash can be applied at regular intervals during the growing season, the last application of nitrogen being at least four weeks before harvesting.

Bulbing onions are day-length sensitive; their bulbs begin growing only after the number of daylight hours has surpassed some minimal quantity. Most traditional European onions are referred to as "long-day" onions, producing bulbs only after 14 hours or more of daylight occurs. Southern European and North African varieties are often known as "intermediate-day" types, requiring only 12–13 hours of daylight to stimulate bulb formation.

Finally, "short-day" onions, which have been developed in more recent times, are planted in mild-winter areas in the autumn and form bulbs in the early spring, and require only 11–12 hours of daylight to stimulate bulb formation. Onions are a cool-weather crop and can be grown in USDA zones 3 to 9. Hot temperatures or other stressful conditions cause them to "bolt", meaning that a flower stem begins to grow.

Characteristics :

The onion **plant** has a fan of hollow, bluish-green **leaves** and its bulb at the base of the **plant** begins to swell when a certain day-**length** is reached. The bulbs are composed of shortened, compressed, underground stems surrounded by fleshy modified scale (**leaves**) that envelop a central bud at the tip of the stem.

Chemical constituents:

1. Quercetin
2. Allinase
3. Allicin
4. Diallyl disulfide
5. Fructan
6. Isorhamnetin
7. Sulphenic acid
8. Diallyl trisulfide

Antioxidant factor :- Quercetin

Onion is good source of antioxidant which is **allium sulphur compound.**

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Onions contain **antioxidants** and compounds that fight inflammation, decrease triglycerides and reduce cholesterol levels — all of which may lower heart disease risk. Their potent anti-inflammatory properties may also help reduce high blood pressure and protect against blood clots.
Onion belongs to the genus Allium in Alliaceae family and contains many cultivars which are colored. Onions are the oldest cultivated vegetables, and are second only after tomatoes, both of which are extensively used not only for culinary purposes all over the world.

Uses of Onion :-

- A particularly valuable flavonoid in onions, which acts as an antioxidant that may be linked to preventing cancer. "It also might have heart health benefits''.
- Onions are healthy whether they're raw or cooked, though raw onions have higher levels of organic sulfur compounds that provide many benefits
- Food Chemistry found that there is a high concentration of flavonoids in the outer layers of onion flesh.
- The **fiber in onions promotes good digestion** and helps keep you regular.
- Additionally, onions contain a special type of soluble fiber called **oligofructose**, which promotes good bacteria growth in your intestines.
- The chromium in onions assists in regulating blood sugar.
- The sulfur in onions helps lower blood sugar by triggering increased insulin production.
- A 2009 study in the journal Menopause found that daily consumption of onions improves bone density in women who are going through or have finished menopause. Women who ate onions frequently had a 20 percent lower risk of hip fracture than those who never ate onions.
- Their potent anti-inflammatory properties may also help reduce high blood pressure and protect against blood clots.
- Onions have also been shown to decrease cholesterol levels.

Fig. Onion

III. GINGER :-

Latin name :- Zingiber officinale
Family :- Zingiberaceae
Biological Source
Ginger consists of the dried rhizomes of the Zingiber officinale Roscoe, belonging to family Zingiberaceae.
Geographical Source
It is mainly cultivated in West Indies, Nigeria, Jamaica, India, Japan, and Africa.

Cultivation

Ginger plant is a perennial herb that grows to 1 m. It is cultivated at an altitude of 600 to 1,500 m above sea level. The herb grows well in well-drained rich, loamy soil, and in abundant rain fall. The rhizome is cut into pieces called fingers, and each finger consisting of a bud is placed in a hole filled with rotten manure in March or April. The rhizomes get matured in December or January. By January the plants wither after flowering and then the flowers are forked up, buds and the roots removed and washed to remove the mould and clay or dirt attached to them. The rhizomes are socked in water overnight and the next morning they are scraped with a knife to remove the outer cork and little of parenchyma. They are washed again and then dried under sun for a week. The rhizomes are turned by the sides at regular intervals to facilitate proper drying. This is the 'unbleached Jamaica' or the uncoated ginger. The coated or the unpeeled variety is prepared by dropping the rhizome for few minutes in boiling water, and then skin is removed such that the layer on the flat surface is removed but not in the grooves between the branches. The 'bleached' or 'limed' is prepared by treating it with sulphuric acid or chlorine or dusting it with calcium sulphate or calcium carbonate.

Characteristics

The rhizomes are 5 to 15 cm long, 3 to 6 cm wide, and about 1.5 cm thick. The Jamaica

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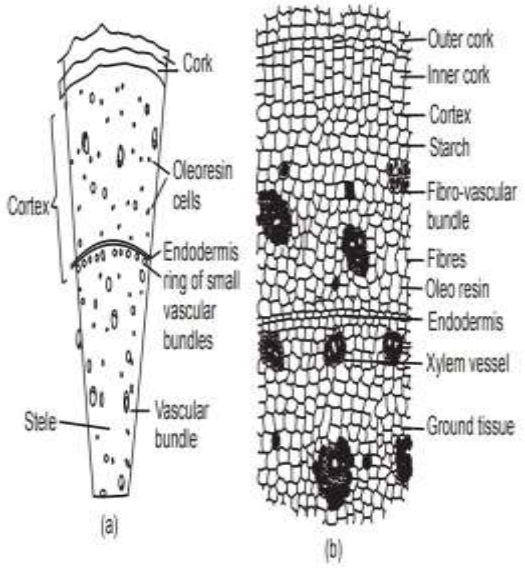
ginger occurs as branches. It has a sympodial branching and the outer surface has buff yellow colour with longitudinally striated fibres. Small circular depressions at the portion of the buds are seen and fractured surface shows narrow bark, a well-developed endodermis, and a wide stele, with scattered small yellowish points of secretion cells and grayish points of fibrovascular bundles. The ginger has agreeable and aromatic odour and pungent and agreeable taste.

Zingiber officinale

Microscopy

The cork is the outermost layer with irregular parenchymatous cells and dark brown colour. The inner cork is few layered, colourless parenchymatous cells arranged in radial rows. Cork is absent in Jamaica ginger. Phellogen is indistinct and the cortex consists of thin-walled rounded parenchyma with intercellular spaces consisting of abundant starch grains. The starch grains are simple, ovate, or sac shaped. Numerous yellowish brown oleoresin are also present along with the collateral fibro vascular bundles. The endodermis is distinct without starch and consists of single layer of tangentially elongated cells containing suberin. Just below the endodermis it has the ground tissue, a ring of narrow zone of vascular bundle which is not covered with sclerenchymatous fibres. The ground tissues contain the large parenchymatous cells rich in starch, oleoresin, fibrovascular bundles. The phloem has well-developed sieve elements, and the xylem consist of vessels, tracheids either annual or spiral, or reticular in nature without lignin. The fibres are unlignified, pitted, and separate.

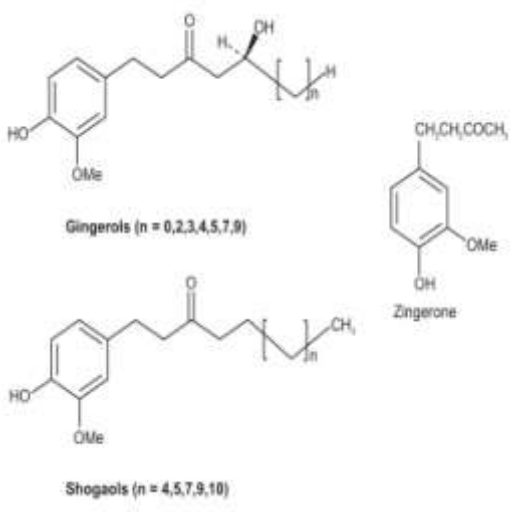


(a) Schematic diagram (T.S.) and, (b) Transverse section of Ginger rhizome

Chemical Constituents

Ginger contains 1 to 2% volatile oil, 5 to 8% pungent resinous mass and starch. The volatile oil is responsible for the aromatic odour and the pungency of the drug is due to the yellowish oily body called gingerol which is odourless. Volatile oil is composed of sesquiterpene hydrocarbon like α-zingiberol; α-sesquiterpene alcohol α-bisabolene, α-farnesene, α-sesquiphellandrene.

Less pungent components like gingerone and shogaol are also present. Shogal is formed by the dehydration of gingerol and is not present in fresh rhizome.



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Antioxidant factor :- Gingerol

Gingerol is the main bioactive compound in ginger, it's responsible for much of ginger's mechanical propertys.

Gingerol has powerful anti-implamntery and antioxidant effect.

Ginger has staring potential for treating a number of ailments including degenerative disorders (arthritis and rheumatism), digestive health (indigestion, constipation and ulcer), cardiovascular disorders (atherosclerosis and hypertension), vomiting, diabetes mellitus, and cancer. It also has anti-inflammatory and anti-oxidative properties for controlling the process of aging. Furthermore, it has antimicrobial potential as well which can help in treating infectious diseases.

Generation of free radicals or reactive oxygen species (ROS) during metabolism beyond the antioxidant capacity of a biological system results in oxidative stress, which plays an essential role in heart diseases, neurodegenerative diseases, cancer, and in the aging process.

The bioactive molecules of ginger like gingerols have shown antioxidant activity in various modules.

Uses of Ginger :-

- Contains gingerol, which has powerful medicinal properties.
- May help with weight loss.
- May drastically lower blood sugars and improve heart disease risk factors.
- Can help treat chronic indigestion.
- May significantly reduce menstrual pain
- May help lower cholesterol levels.
- The anti-cancer properties are attributed to gingerol, which is found in large amounts in raw ginger.
- May improve brain function and protect against Alzheimer's disease.
- Can help fight infections.
- Taking ginger by mouth seems to reduce nausea and vomiting in some pregnant women.
- taking ginger by mouth can slightly reduce pain in some people with osteoarthritis.

Fig. Ginger

LEMON :-

Latin name :- Citrus limon

Family:- Rutaceae

Biological Sources :

Lemon is the fruit of Citrus limon (L.) Burm., a small tree of the family Rutaceae.

Geographical source:

Lemons are widely cultivated in many countries of the world including Africa, the Mediterranean countries, Australia, many European and North and South American countries.

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Characteristics :

The **lemon**, Citrus limon, is a species of small evergreen tree in the flowering plant family Rutaceae, native to South Asia, primarily North eastern India.

The tree's ellipsoidal yellow fruit is used for culinary and non-culinary purposes throughout the world, primarily for its juice, which has both culinary and cleaning uses.[2] The pulp and rind are also used in cooking and baking. The juice of the lemon is about 5% to 6% citric acid, with a pH of around 2.2, giving it a sour taste. The distinctive sour taste of lemon juice makes it a key ingredient in drinks and foods such as lemonade and lemon meringue pie.

Chemical constituents :

1. Citral
2. Limonene
3. Beta-pinene
4. Geranyl acetate
5. Citronellal
6. Citric acid
7. Hesperidin

Antioxidant Factor :- Flavonoids, Citrates, Vitamin E, Vitamin C, Lemonades.

Lemons are an excellent source of Vitamin C and flavonoids, which are antioxidants. Antioxidants helps to remove free radicals that can damage cells from the body.

These neutrients can help to prevent diseases and boots health and well being.

Lemons give flavor to baked goods, sauces, salad dressings, marinades, drinks, and desserts, and they are also a good source of vitamin C.

One 58 gram (g) lemon can provide over 30 milligrams (mg) of vitamin C.

Vitamin C is essential for health, and a deficiency can lead to health problems. The early explorers knew this and took lemons on their long voyages to help prevent or treat scurvy, a life threatening condition that was common among sailors.

Uses of Lemon :-

- Lowering stroke risk
- The role of lemon in this improvement and to discover whether consuming lemon can help reduce blood pressure since walking daily can also lower blood pressure.
- Cancer prevention - Lemons and lemon juice are an excellent source of the antioxidant vitamin C.Antioxidants may help prevent free radicals from causing cell damage that can lead to cancer. However, exactly how antioxidants can help prevent cancer remains unclear.
- Preventing asthma - People with asthma who consume higher amounts of vitamin C and other nutrients when they have a cold may experience fewer asthma attacks, according to one review.

The authors found evidence that vitamin C also benefitted people with bronchial hypersensitivity when they also had a common cold.

- Boosting the immune system - Foods that are high in vitamin C and other antioxidants may help strengthen the immune system against the germs that cause the common cold and the flu.

Fig. Lemon

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IV. TURMERIC :-

Latin name :- Curcuma, longa
Family:- Zingiberaceae
Biological Source

Turmeric is the dried rhizome of Curcuma longa Linn. (syn. C.domestica Valeton)., belonging to family Zingiberaceae.

Geographical Source

The plant is a native to southern Asia and is cultivated extensively in temperate regions. It is grown on a larger scale in India, China, East Indies, Pakistan, and Malaya.

Cultivation

Turmeric plant is a perennial herb, 60–90 cm high with a short stem and tufted leaves; the rhizomes, which are short and thick, constitute the turmeric of commerce. The crop requires a hot and moist climate, a liberal water supply and a well-drained soil. It thrives on any soil-loamy or alluvial, but the soil should be loose and friable. The field should be well prepared by ploughing and turning over to a depth of about 30 cm and liberally manured with farmyard and green manures. Sets or fingers of the previous crop with one or two buds are planted 7 cm deep at distance of 30–37 cm from April to August. The crop is ready for harvesting in about 9–10 months when the lower leaves turn yellow. The rhizomes are carefully dug up with hard picks, washed, and dried.

Characteristics

The primary rhizomes are ovate or pear-shaped, oblong or pyriform or cylindrical, and often short branched. The rhizomes are known as ‘bulb’ or ‘round’ turmeric. The sec-ondary, more cylindrical, lateral branched, tapering on both ends, rhizomes are 4–7 cm long and 1–1.5 cm wide and called as ‘fingers’. The bulbous and finger-shaped parts are separated and the long fingers are broken into convenient bits. They are freed from adhering dirt and fibrous roots and subjected to curing and polishing process. The curing consists of cooking the rhizomes along with few leaves in water until they become soft. The cooked rhizomes are cooled, dried in open air with intermittent turning over, and rubbed on a rough surface. Colour is deep yellow to orange, with root scar and encircling ridge-like rings or annulations, the latter from the scar of leaf base. Fracture is horny and the cut surface is waxy and resinous in appearance. Outer surface is deep yellow to brown and longitudinally wrinkled. Taste is aromatic, pungent and bitter; odour is distinct.

Rhizomes and whole plant of turmeric

Microscopy

The transverse section of the rhizome is characterized by the presence of mostly thin-walled rounded parenchyma cells, scattered vascular bundles, definite endodermis, few layers of cork developed under the epidermis, and scattered oleoresin cells with brownish contents. The epidermis is consisted of thick-walled cells, cubical in shape, of various dimensions. The cork cambium is developed from the sub-epidermal layers and even after the development of the cork, the epidermis is retained. Cork is generally composed of four to six layers of thin-walled brick-shaped parenchymatous cells. The parenchyma of the pith and cortex contains grains altered to a paste, in which sometimes long lens shaped unaltered starch grains of 4–15 μm diameter are found. Oil cells have suberised walls and contain either orange-yellow globules of a volatile oil or amorphous resinous masses. Cortical vascular bundles are scattered and are of a collateral type. The vascular bundles in the pith region are mostly scattered and they form discontinuous ring just under the endodermis. The vessels have mainly spiral thickenings and only a few have reticulate and annular structure.

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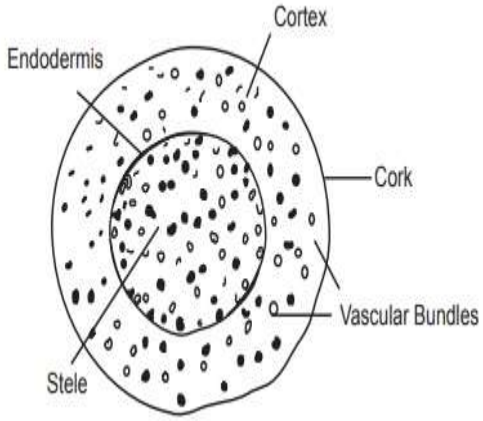
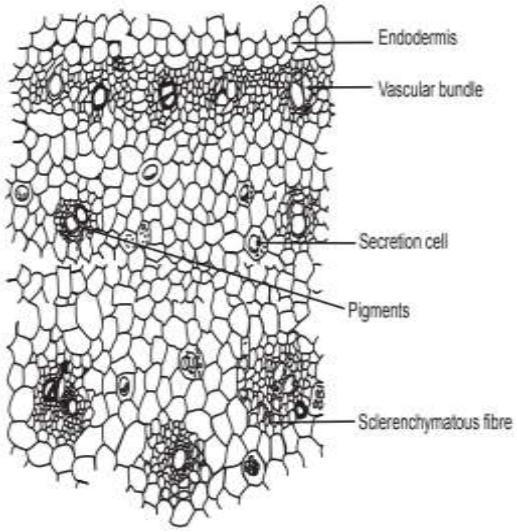


T.S. (schematic) of turmeric rhizome

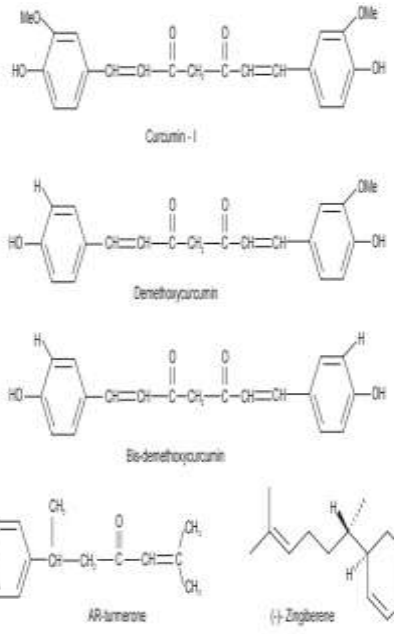


Transverse section of turmeric rhizome

Chemical Constituents

Turmeric contains yellow colouring matter called as curcuminoids (5%) and essential oil (6%). The chief constituent of the colouring matter is curcumin I (60%) in addition with small quantities of curcumin III, curcumin II and dihydrocurcumin. The volatile oil contains mono- and sesquiterpenes like zingiberene (25%), α-phellandrene, sabinene, turmerone, arturmerone, borneol, and cineole. Choleretic action of the essential oil is attributed to β-tolylmethyl carbinol.

The volatile oil also contains α- and β-pinene, camphene, limonene, terpinene, terpinolene, caryophyllene, linalool, isoborneol, camphor, eugenol, curdione, curzerenone, curlone, AR-curcumenes, β-curcumene, γ-curcumene. α- and β-turmerones, and curzerenone.



Antioxidant Factor :- curcumin,

Curcumin is the main active ingrident. Turmeric has powerful anti-inflametory and is a very strong antioxidant. However the curcumin content of turmeric is not that high.

turmeric is a good source of natural flavonoids, which have been shown to have antioxidant activity, free radical-scavenging capacity, coronary heart disease preventive activities, and anticancer activities.

Turmeric is a golden spice derived from the rhizome of the Curcuma longa plant, which belongs to the Zingiberaceae family. Since ancient times, turmeric has been used as the principal ingredient of dishes originating from Bangladesh and India for its color, flavor, and taste. It is also used in social and religious ceremonies in Ayurvedic and folk medicines against various ailments, including gastric, hepatic, gynecological, and infectious diseases.

Dry turmeric contains 69.43% carbohydrates, 6.3% proteins, 5.1% oils, 3.5% minerals, and other elements. The bioactive chemical constituents in turmeric have been extensively investigated. To date, approximately 235 compounds, primarily phenolics and terpenoids, have been identified from various species of turmeric, including twenty-two diarylheptanoids and diarylpentanoids, eight phenylpropenes as well as other phenolics, sixty-eight monoterpenes, 109 sesquiterpenes, five

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diterpenes, three triterpenoids, four sterols, two alkaloids, and fourteen other compounds. Curcuminoids (mostly curcumin) and essential oils (primarily monoterpenes) are the major bioactive constituents showing different bioactivities. Calebin-A, vanillic acid, vanillin, quercetin, and other phenolic compounds have also previously been identified from turmeric.

Uses of Turmeric :-

- Turmeric Contains Bioactive Compounds With Powerful Medicinal Properties
- Turmeric is the spice that gives curry its yellow color. It has been used in India for thousands of years as a spice and medicinal herb.
- It helps your body fight foreign invaders and also has a role in repairing damage.
- Oxidative damage is believed to be one of the mechanisms behind aging and many diseases.
- Curcumin Should Lower Your Risk of Heart Disease.
- Turmeric Can Help Prevent (And Perhaps Even Treat) Cancer.
- Curcumin May Be Useful in Preventing and Treating Alzheimer's Disease.
- Studies Show That Curcumin Has Incredible Benefits Against Depression.

Fig. Turmeric

VI. CONCLUSION :-

Antioxidants are substances that can prevent or slow damage to cells caused by free radicals, unstable molecules that the body produces as a reaction to environmental and other pressures.

They are sometimes called "free-radical scavengers."

The sources of antioxidants can be natural or artificial. Certain plant-based foods are thought to be rich in antioxidants. Plant-based antioxidants are a kind of phytonutrient, or plant-based nutrient. The body also produces some antioxidants, known as endogenous antioxidants. Antioxidants that come from outside the body are called exogenous.

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