NUTRITIONAL , PHYTOCHEMICAL AND MEDICINAL PROPERTIES OF FRUITS OF INDIA

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PREFACE

Fruits and vegetables have caught the attention of nutrition researchers much more than ever before. Though they were considered as protective foods for very long time, not much of scientific information regarding its role and mechanism in curing the diseases were available. Modern understanding of the disease development process has led the scientists to search for newer molecules from natural sources like fruits and vegetables. With studies undertaken using individual antioxidants in curing present day diseases like cancer, diabetes, cardiovascular diseases, Alzheimer's disease, Parkinson's disease, etc., the biomolecules present in a variety of fruits and vegetables and its role in curing diseases or protecting against development of some of them, began to be understood better. It is now known that, not a single molecule or two are responsible for bringing about the cure but supplementary and complimentary action of several compounds / bio-molecules present in natural sources like fruits and vegetables are responsible for their curative properties. At this juncture when insufficient consumption of fruits and vegetables is implicated in modern lifestyle diseases and disorder, research on role of nutrition, particularly natural foods, has been accorded highest priority all over the world. Therefore, we thought it appropriate to gather the scientific information regarding their role and mechanism of action and present it to the readers in a comprehensive form. Though, Indian Materia Medica has been a wealth of information on medicinal properties of all plants, not all fruits of present day are covered there and for a group of readers with specific interest in fruits, this type of information is not available at a place. As the fruits and vegetables are emerging as protection against various diseases, investment in this research is being made with renewed vigour. With the increase in scientific temperament of common man, time demands better evidence to substantiate any claim.

This book on nutritional facts and phytochemicals of fruits and their role in curing of diseases with pharmacological evidence either on animal models or human beings would help the readers to understand the subject in greater depth. It will provide a bird's eye view of present status of information on this subject and will help researchers to carry the interest forward. As far as possible, effort has been made to link the traditional knowledge available on each fruit crop regarding their curative properties to the modern scientific validation of the fact. While some have been convincingly proved, some needs further validation.

Effort has been made to organize the content crop wise in a logical sequence. References have been provided at the end of each fruit for further reading and better understanding of the subject. It is believed that this effort will help the students/researchers/scientists and common man alike to look at the fruits and vegetables as protective foods not just because it is said so, but with a scientific acceptance and proof.

Any suggestions, inputs, information and assistance for improving it further would be highly appreciated.

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Human Nutrition and Health

Food, Water and Air are three essential element for existence and sustenance of life. Primarily food is manufactured by the plants by trapping the energy of Sun in presence of carbondioxide and water. Foods can be broadly classified into energy foods and protective foods. While energy is required for all bodily functions, protective foods confer a degree of resistance against diseases, correct some disorder and prevents occurrence of certain conditions due to deficiency of certain elements and phytochemicals. The balanced diets are those which have a appropriate amount of carbohydrates, proteins and fats. All these three components play certain essential role in the process of metabolism. Deficiency or insufficiency of these major food components may lead to energy deficient disease conditions and are considered responsible for malnutrition world wide. Energy deficiency can threaten the existence of life. Food grains, tubers and roots are major sources of carbohydrates, proteins and fats. Sufficient intake of carbohydrates, proteins and fats alone does not ensure a healthy body. Health and wellbeing are the two important aspects of life, which makes it worth living. For being healthy, body requires minerals and vitamins which are present mainly in fruits and vegetables only. Phytochemicals present in fruits and vegetables cleanses the body and fights against diseases. Therefore, for a healthy life we need to consume a balanced diet comprising of appropriate amounts of carbohydrates, proteins, fats, fruits and vegetables. While the former three can be consumed based on the energy requirement of an individual, one should consume at least 180 and 300 grams of fruits and vegetables respectively everyday.

Carbohydrates

Carbohydrates are the major source of energy for the body. They are composed mostly of the elements carbon (C), hydrogen (H), and **oxygen** (O). Through the bonding of these elements, carbohydrates provide energy for the body in the form of kilocalories (kcal), with an average of 4 kcal per gram (kcal/g) of carbohydrates (a kcal is equivalent to a calorie on a nutritional label of a packaged food).

Carbohydrates come in a variety of sizes. The smallest carbohydrates are the simple sugars, also known as monosaccharides and disaccharides, meaning that they are made up of one or two sugar **molecules** . The best known simple sugar is table sugar, which is also known as **sucrose** , a disaccharide. Other simple sugars include the monosaccharides **glucose** and fructose, which are found in fruits, and the disaccharides, which include sucrose, lactose (found in milk), and maltose (in beer and malt liquors). The larger carbohydrates are made up of these smaller simple sugars and are known as polysaccharides (many sugar molecules) or complex carbohydrates. These are usually made up of many linked glucose molecules, though, unlike simple sugars, they do not have a sweet taste. Examples of foods high in complex carbohydrates include potatoes, beans, and vegetables. Another type of complex carbohydrate is dietary **fiber** . However, although fiber is a complex carbohydrate made up of linked sugar molecules, the body

cannot break apart the sugar linkages and, unlike other complex carbohydrates, it passes through the body with minimal changes.

Although carbohydrates are not considered to be an essential nutrient, the body depends on them as its primary energy source. The body utilizes most carbohydrates to generate glucose, which serves as the basic functional molecule of energy within the cells of the human body (glucose is broken down to ultimately produce adenosine triphosphate, or ATP, the fundamental unit of energy). When the supply of carbohydrates is too low to adequately supply all the energy needs of the body, **amino acids** from proteins are converted to glucose.

Proteins

Proteins are composed of the elements carbon (C), oxygen (O), hydrogen (H), and **nitrogen** (n). They have a variety of uses in the body, including serving as a source of energy, as substrates (starter materials) for tissue growth and maintenance, and for certain **biological** functions, such as making structural proteins, transfer proteins, **enzyme** molecules, and **hormone** receptors. Proteins are also the major component in bone, muscle, and other tissues and fluids. When used for energy, protein supplies an average of 4 kcal/g.

Proteins are formed by the linking of different combinations of the twenty common amino acids found in food. Of these, ten are essential for the human in the synthesis of body proteins (eight are essential throughout a human's life, whereas two become essential during periods of rapid growth, such as during infancy).

Protein may be found in a variety of food sources. Proteins from animal sources (meat, poultry, milk, fish) are considered to be of high biological value because they contain all of the essential amino acids. Proteins from plant sources (wheat, corn, rice, and beans) are considered to be of low biological value because an individual plant source does not contain all of the essential amino acids. Therefore, combinations of plant sources must be used to provide these nutrients.

However, when protein intake is inadequate, but total caloric intake is sufficient, a condition known as **kwashiorkor** may occur. Symptoms of kwashiorkor include an enlarged stomach, loss of hair and hair color, and an enlarged liver. Conversely, if protein and caloric intake are both inadequate, a condition known as **marasmus** occurs. Marasmus presents with a stoppage of growth, extreme muscle loss, and weakness.

Lipids

Lipids, which consist of fats and oils, are high-energy yielding molecules composed mostly of carbon (C), hydrogen (H), and oxygen (O) (though lipids have a smaller number of oxygen molecules than carbohydrates have). This small number of oxygen molecules makes lipids **insoluble** in water, but soluble in certain organic solvents. The basic structure of lipids is a **glycerol** molecule consisting of three carbons, each

attached to a fatty-acid chain. Collectively, this structure is known as a **triglyceride** , or sometimes it is called a triacylglycerol. Triglycerides are the major form of energy storage.

Lipids can be broken down into two types, saturated and unsaturated, based on the chemical structure of their longest, and therefore dominant, fatty acid. Whether a lipid is solid or liquid at room temperature largely depends on its property of being saturated or unsaturated. Lipids from plant sources are largely unsaturated, and therefore liquid at room temperature. Lipids that are derived from animals contain a higher amount of saturated fats, and they are therefore solid at room temperature. An exception to this rule is fish, which, for the most part, contain unsaturated fat. The important difference between saturated and unsaturated **fatty acids** is that saturated fatty acids are the most important factor that can increase a person's **cholesterol** level. An increased cholesterol level may eventually result in the clogging of blood **arteries** and, ultimately, **heart disease** .

Not all fatty acids are considered harmful. In fact, certain unsaturated fatty acids are considered essential nutrients. Like the essential amino acids, these fatty acids are essential to a person's diet because the body cannot produce them. The **essential fatty acids** serve many important functions in the body, including regulating **blood pressure** and helping to synthesize and repair vital cell parts. Lipids are also required for the **absorption** of fat-soluble vitamins, and they are generally thought to increase the taste and flavor of foods and to give an individual a feeling of fullness.

Vitamins

Vitamins are chemical compounds that are required for normal growth and **metabolism** . Some vitamins are essential for a number of metabolic reactions that result in the release of energy from carbohydrates, fats, and proteins. There are thirteen vitamins, which may be divided into two groups: the four fat-soluble vitamins (vitamins A, D, E, and K) and the nine water-soluble vitamins (the **B vitamins** and vitamin C). These two groups are dissimilar in many ways. First of all, cooking or heating destroys the water-soluble vitamins much more readily than the fat-soluble vitamins. On the other hand, fat-soluble vitamins are much less readily excreted from the body, compared to water-soluble vitamins, and can therefore accumulate to excessive, and possibly toxic, levels. This means, of course, that levels of water-soluble vitamins in the body can become depleted more quickly, leading to a vitamin deficiency if those nutrients are not replaced regularly. Deficiencies of vitamins may result from inadequate intake, as well as from factors unrelated to supply. For instance, vitamin K and **biotin** are both produced by **bacteria** that live within the **intestines** , and a person can become deficient if these bacteria are removed by **antibiotics** . Other factors that may result in a vitamin deficiency include disease, pregnancy, drug interactions, and newborn development (newborns lack the intestinal bacteria that create certain vitamins, such as biotin and vitamin K).

Minerals

Minerals are different from the other nutrients discussed thus far, in that they are inorganic compounds (carbohydrates, proteins, lipids, and vitamins are all organic compounds). The fundamental structure of minerals is usually nothing more than a molecule, or molecules, of an element. The functions of minerals do not include participation in the yielding of energy. But they do play vital roles in several **physiological** functions, including critical involvement in **nervous system** functioning, in cellular reactions, in water balance in the body, and in structural systems, such as the skeletal system.

Because minerals have a very simple structure of usually one or more molecules of an element, they are not readily destroyed in the heating or cooking process of food preparation. However, they can leak out of the food substance that contains them and seep into the water or liquid the food is being cooked in. This may result in a decreased level of minerals being consumed if the liquid is discarded.

There are many minerals found within the human body, but of the sixteen (or possibly more) essential minerals, the amount required on a daily basis varies enormously. This is why minerals are subdivided into two classes: macrominerals and microminerals. Macrominerals include those that are needed in high quantities, ranging from milligrams to grams. **Calcium** , phosphorous, and magnesium are macrominerals. Microminerals are those necessary in smaller quantities, generally between a microgram and a milligram. Examples of microminerals include copper, chromium, and selenium. Dietary requirements for some minerals have yet to be established.

Water

Water makes up the last class of nutrients, though the fact that it is considered a nutrient is surprising to many people. Water, however, has many necessary functions in the human body. Some of its actions include its use as a solvent (a substance that other substances dissolve in), as a lubricant, as a conduction system for transportation of vital nutrients and unnecessary waste, and as a mode of temperature regulation.

There are many available sources of water other than tap water and bottled water. Some foods have a high water content, including many fruits and vegetables. In addition, the body can make small amounts of water from various metabolic processes that result in molecules of water as a by-product. This, however, is by no means sufficient for the body's needs of water. It is generally recommended that people drink eight cups (or nearly 2 liters) of water a day to maintain an adequate supply.

Nutritional Deficiency and Its Symptoms

Nutrient	Incidence of Deficiency	Typical Symptoms and Diseases
Biotin	Uncommon	Dermatitis, eye inflammation, hair loss, loss of muscle control, insomnia, muscle weakness
Calcium	Average diet contains 40 to 50% of RDA	Brittle nails, cramps, delusions, depression, insomnia, irritability, osteoporosis, palpitations, peridontal disease, rickets, tooth decay
Chromium	90% of diets deficient	Anxiety, fatigue, glucose intolerance, adult-onset diabetes
Copper	75% of diets deficient; average diet contains 50% of RDA	Anemia, arterial damage, depression, diarrhea, fatigue, fragile bones, hair loss, hyperthyroidism, weakness
Essential fatty acids	Very common	Diarrhea, dry skin and hair, hair loss, immune impairment, infertility, poor wound healing, premenstrual syndrome, acne, eczema, gall stones, liver degeneration
Folic acid	Average diet contains 60% of RDA*; deficient in 100% of elderly in one study; deficient in 48% of adolescent girls; requirement doubles in pregnancy	Anemia, apathy, diarrhea, fatigue, headaches, insomnia, loss of appetite, neural tube defects in fetus, paranoia, shortness of breath, weakness
Iodine	Uncommon since the supplementation of salt with iodine	Cretinism, fatigue, hypothyroidism, weight gain
Iron	Most common mineral deficiency	Anemia, brittle nails, confusion, constipation, depression, dizziness, fatigue, headaches, inflamed tongue,
Magnesium	75 to 85% of diets deficient: average diet contains 50 to 60% of RDA*	Anxiety, confusion, heart attack, hyperactivity, insomnia, nervousness, muscular irritability, restlessness,
Manganese	Unknown, may be common in women	Atherosclerosis, dizziness, elevated cholesterol, glucose intolerance, hearing loss, loss of muscle control, ringing in

Niacin	Commonly deficient in elderly	Bad breath, canker sores, confusion, depression, dermatitis, diarrhea, emotional instability, fatigue, irritability, loss of appetite, memory impairment, muscle weakness, nausea, skin eruptions and inflammation
Pantothenic acid (B5)	Average elderly diet contains 60% of RDA*	Abdominal pains, burning feet, depression, eczema, fatigue, hair loss, immune impairment, insomnia, irritability, low blood pressure, muscle spasms, nausea, poor coordination
Potassium	Commonly deficient in elderly	Acne, constipation, depression, edema, excessive water consumption, fatigue, glucose intolerance, high cholesterol levels, insomnia, mental impairment, muscle weakness, nervousness, poor reflexes
Pyridoxine (B6)	71% of male and 90% of female diets deficient	Acne, anemia, arthritis, eye inflammation, depression, dizziness, facial oiliness, fatigue, impaired wound healing, irritability, loss of appetite, loss of hair, mouth lesions, nausea
Riboflavin	Deficient in 30% of elderly Britons	Blurred vision, cataracts, depression, dermatitis, dizziness, hair loss, inflamed eyes, mouth lesions, nervousness, neurological symptoms (numbness, loss of sensation, "electric shock" sensations), seizures. sensitivity to light, sleepiness, weakness

Predisposing factors for Diseases

A balanced diet having essentially fruits and vegetables would take care of many of the disease conditions. However, lifestyle and diet are the two most important phenomena which are responsible for modern day diseases. Sedentary lifestyle has become the hallmark of modern man. Hence the requirement of energy for physical work has reduced while calorie consumption has increased resulting in lifestyle disorders like obesity, diabetes, hyperlipidemia, etc. Food habits have attained a level of fashion displaying its association with social status and modernity. Eating has become a pleasure rather than satisfying the hunger.

There is substantial evidence that changes in diet are responsible, in part, for the diseases that have emerged as dominant health problems in industrialized countries over the past century. Cross-country epidemiological studies have consistently demonstrated a difference in the prevalence of coronary heart disease, hypertension, diabetes and some types of cancer (Neel *et al.* 1998; Bingham 2000; Zimmet *et al.* 2001), which are related to differences in diet. These diets are usually monotonous and very restricted, lacking in fresh fruit and vegetables, and containing large amounts of fat and refined carbohydrates (Gracey 2000). Now a consensus has been reached which suggests that a predominantly plant-based diet rich in fruits and vegetables, pulses and minimally processed starchy staple foods reduces the risk for development of these diseases significantly.

One of the most important messages of modern nutrition research is that a diet rich in fruits and vegetables protects against dreadful diseases like cancer. The **greatest** message is that this same diet protects against almost all other diseases, too, including cardiovascular disease and diabetes. There are many mechanisms by which fruits and vegetables are protective, and an enormous body of research supports the recommendation for people to eat more fruits and vegetables.

Modern Theory of Disease Development

Recent scientific research has helped us in exploring the hidden mechanisms of disease development. Oxidative stress has been reported to be responsible for development of most of the modern lifestyle disorders and diseases. Reactive oxygen species or free radicals are involved in oxidative stress. Reactive oxygen species (ROS), such as hydrogen peroxide, superoxide and hydroxyl radical are products of oxygen metabolism in all aerobic organisms. ROS are generated as a result of energy production from mitochondria (from the electron transport chain), as part of an antimicrobial or antiviral response, as well as detoxification reactions carried out by the cytochrome P-450 system. Environmental agents such as ultraviolet light, ionizing radiation, redox chemicals and cigarette smoke also readily generate ROS. The antioxidant defense system in most cells is composed of two components, the antioxidant enzymes component which includes enzymes such as superoxide dismutase, catalase and glutathione peroxidase, and the low molecular weight antioxidants component that includes vitamins A and E, ascorbate, glutathione and thioredoxin. These substances are the body's natural defence against endogenous generated ROS and other free radicals, as well as ROS generated by external environmental factors. Oxidative stress occurs when the production of ROS exceeds the body's natural antioxidant defence mechanisms, causing damage to biomolecules such as lipids, proteins and DNA (Gordon, 1996).

Effects of ROS on cell metabolism have been well documented in a variety of species. These include not only roles in apoptosis (programmed cell death) but also

positive effects such as the induction of host defence (Rada and Leto, 2008; Conner et al, 2002) genes and mobilisation of ion transport systems. This implicates them in redox signaling, also known as oxidative signaling. In particular, platelets involved in wound repair and blood homeostasis release ROS to recruit additional platelets to sites of injury. These also provide a link to the adaptive immune system via the recruitment of leukocytes.]

Reactive oxygen species are implicated in cellular activity to a variety of inflammatory responses including cardiovascular disease. They may also be involved in hearing impairment via cochlear damage induced by elevated sound levels, in ototoxicity of drugs such as cisplatin, and in congenital deafness in both animals and humans. Redox signaling is also implicated in mediation of apoptosis or programmed cell death and ischaemic injury. Specific examples include stroke and heart attack. This is why the January 2011 Nutrition Action Health Letter says that fruits and vegetables (containing antioxidants, which counteract the destructive processed of reactive oxygen species) are likely to lower risk of stroke and heart attack (Liebman, 2011).

In general, harmful effects of reactive oxygen species on the cell are most often

1. damage of DNA
2. oxidations of polydesaturated fatty acids in lipids (lipid peroxidation)
3. oxidations of amino acids in proteins
4. oxidatively inactivate specific enzymes by oxidation of co-factors

Oxidative stress has been thought to contribute to the general decline in cellular functions that are associated with many human diseases including Alzheimer disease, amyotrophic lateral sclerosis (ALS), Parkinson disease, atherosclerosis, ischemia/ reperfusion, neuronal injuries, degenerative disease of the human temporomandibular-joint , cataract formation, macular degeneration , degenerative retinal damage, rheumatoid arthritis, multiple sclerosis, muscular dystrophy, human cancers as well as the aging process itself.

How Fruit and Vegetable based diet helps in fighting diseases?

When the oxidative stress is acute, an external supplementation of antioxidants (both water-soluble andlipid-soluble) can reduce the damage caused due to ROS and free radicals. There are many substances that are protective in fruits and vegetables, so that the entire effect is not very likely to be due to any single nutrient or phytochemical. Steinmetz and Potter (1996) listed possible protective elements : dithiolthiones, isothiocyanates, indole-32-carbinol, allium compounds, isoflavones, protease inhibitors, saponins, phytosterols, inositol hexaphosphate, vitamin C, D-limonene, lutein, folic acid, beta carotene (and other carotenoids), lycopene, selenium, vitamin E, flavonoids, and dietary fiber . The most important mechanism by which these antioxidants act is likely to

be by free radical scavenging in which the polyphenols can break the free radical chain reaction [de Groot and Rauen, 1998]. A number of studies have been carried out on the structure and activity of flavonoids (Formica and Regelson, 1995) and their role in disease prevention.

Since the mid 1980s, numerous studies have shown the relation between colorectal cancer and consumption of fruit and vegetables. The hypotheses as to how fruit and vegetable intake may reduce the risk of colon or rectal cancer are numerous and involve independently or additively the many potential anticarcinogenic compounds found in fruit and vegetables (eg, fiber, carotenoids, vitamin C, folate, glucosinolates, and allium compounds) (Millen et al, 2007).

It has been becoming clear that there is a relationship between antioxidants in a diet
and immune functions. The antioxidants prevent the lipid peroxidation by preventing the loss of membrane fluidity which in turn determines much of the protective functions of immune cells (Middleton, 1998). The carotenes protects the immunity due to its capacity to quench antioxidants and single oxygen [de Groot and Rauen, 1998]. Polyphenols, another antioxidant, acts by effectively scavenging free radicals. Recent studies have shown that flavonoids and polyphenols derived from fruits, avoid lymphocyte proliferation and IL-2 production. The prevention of proliferation of lymphocyte is associated with the inhibition of protein kinase C (PKC) activity, which is involved in cellular signal transduction.

Most of the phytochemicals in the fruits and vegetables helps in disease prevention through mechanism related to antioxidant activity, modulation of detoxification enzymes, stimulation of the immune system, decreased platelet aggregation, alterations of cholesterol metabolism, modulation of steroid hormone concentrations, hormone metabolism, blood pressure reduction, antibacterial and antiviral activity.

Traditional dietary recommendations were based on preventing nutrient deficiency disorders. Future recommendations also must take into account prevention of degenerative disease and slowing of the ageing process, caused by damage to nuclear and mitochondrial DNA (Tait, 2003) . This is possible only by including liberal amounts of fruits and vegetables in our daily diet.

A matter of concern with growing population is the shift of people from rural to urban areas both for earning a livelihood and better access to other essentialities of modern life. With increasing cost of living, the protective foods like fruits and vegetables are going out of access to majority of urban poor. The earlier school of thought that malnutrition prevailed in rural areas is shifting its focus to urban population not only in India but also many other developing world. Further to that, the data generated on genetic

predisposing of Indian population to modern diseases like diabetes, cardiovascular diseases, dementia, etc., makes it essential to feed the people with more and more of fruits and vegetables.

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1. MANGO (*Mangifera indica* L.)

Mango belongs to the family Anacardiaceae. The fruits are lusciously juicy, with pleasant aroma and sweet taste. It is considered as king of fruits. Native to southern Asia, especially eastern India, Burma, and the Andaman Islands, the mango has been cultivated, praised and even revered in India since ancient times. The fruit is used for various purposes while, leaves, stone, peel and other parts have several traditional uses.It is considered to be one of the richest source of beta-carotene, the precursor of vitamin A.

Nutritional Composition

Component	**Quantity per 100g**	**Component**	**Quantity per 100g**
Moisture	81.00 g	Pantothenic acid	0.160 mg
Carbohydrates	17.00 g	Vitamin B_6	0.134 mg
Protein	0.51 g	Folate (Vit. B_9)	14 µg
Fat	0.27 g	Vitamin C	27.7 mg
Dietary fiber	1.8 g	Calcium	14 mg
Vitamin A equiv.	38 µg	Phosphorus	11 mg
beta-carotene	445 µg	Potassium	16 mg
Thiamine (Vit. B_1)	0.058 mg	Magnesium	9 mg
Riboflavin (Vit. B_2)	0.057 mg	Zinc	0.04 mg
Niacin (Vit. B_3)	0.584 mg	Iron	1.30 mg

Source : http://en.wikipedia.org/wiki/Mango accessed on 14.04.2011; (Gopalan et al., 1985).

Uses

Mangoes are used as fresh fruit for dessert purposes. It is also used in several processed forms. Various parts of mango are used for different purposes. Leaves are used for decorating the doors of houses on auspicious occasions. Flowers as delicacy during certain festivals. Bark and roots have medicinal properties and are used in traditional systems of medicine.

Consumption of mango has several health benefits

- □It vitalizes the body and give nourishment to it.

- □It promotes semen secretion.
- It improves vision in eyes and it is said to be useful in ophthalmia and eruptions.
- The rind of the fruit is an astringent and is also a stimulant tonic in debility of the stomach.
- Ripe fruit is a laxative and is used for habitual constipation.

Phytochemicals

Mango is rich in a variety of phytochemicals (Ajila and Rao, 2008) and nutrients. The fruit pulp is high in prebiotic dietary fiber, vitamin C, diverse polyphenols and provitamin A carotenoids (Berardini et al.,, 2005).

Mango contains essential vitamins and dietary minerals. The antioxidant vitamins A, C and E compose 25%, 76% and 9% of the Dietary Reference Intake (DRI) in a 165 grams (5.8 oz) serving. Vitamin B_6 (pyridoxine, 11% DRI), vitamin K (9% DRI), other B vitamins and essential nutrients, such as potassium, copper and 17 amino acids are at good levels. Mango peel and pulp contain other phytonutrients, such as the pigment antioxidants – carotenoids and polyphenols – and omega-3 and -6 polyunsaturated fatty acids.

Mango peel contains pigments that may have antioxidant properties, (Ajila and Rao, 2008; Gouado et al., 2007)) including carotenoids, such as the provitamin A compound, beta-carotene, lutein and alpha-carotene (Mahattanatawee et al., 2006) polyphenols (Singh et al., 2004; Andreu et al., 2005) such as quercetin, kaempferol, gallic acid, caffeic acid, catechins, tannins, and the unique mango xanthonoid, mangiferin (Percival et al., 2006) any of which may counteract free radicals in various disease processes as revealed in preliminary research (Rodriguez et al., 2006; Ribeiro et al.,, 2006). Phytochemical and nutrient content appears to vary across mango species (Chen et al., 2004).Up to 25 different carotenoids have been isolated from mango pulp, the densest of which was beta-carotene, which accounts for the yellow-orange pigmentation of most mango species (Barreto et al.,, 2008). Peel and leaves also have significant polyphenol content, including xanthonoids, mangiferin and gallic acid (Chatuvedi et al., 2008). The mango triterpene, lupeol (Prasad et al., 2008) is an effective inhibitor in laboratory models of prostate and skin cancers(Nigam and Shukla, 2007; Saleem et al.,,2004; Rodeiro et al., 2006). An extract of mango branch bark called Vimang, isolated by Cuban scientists, contains numerous polyphenols with antioxidant properties in vitro and on blood parameters of elderly humans (Pardo et al.,2006).

Globally , researchers has continue to investigate mango usefulness to mankind. They have found out that mango extracts can control blood sugar,relieve diarrhoea, fever, pain, kill malaria parasite and infectious disease agent such as S*taphylococcus aureus*. Also it contains vitamin needed by body.

Mango as a plant or tree has medicinal value that ranges from its fruit extract, leaf, stem bark extract, dried mango flower and extract of unripe fruits and of bark stem and

leaves have shown antibiotic activity. Also, the leaf decotion is taken as a remedy for chest complaints, diabetesand hypertension.

Therefore, it is now glaring that mango is a fruit that we should not be unfarmiliar with because tannin it contains have been shown to serve as astrigent in cases of diarrhoea, chronic dysentery, catarrh of the bladder and chronic urethritis resulting from gonorrhoea so mango is natural curative plant without any side effects

Mangoes are good for the kidneys, digestive system of the body and the skin. It relieves clogged skin pores, reduces cysts, excess body heat and fever. All parts of the mango have medicinal uses. Unripe mangoes have oxalic, citric, malic, tartaric and succinnic acids which results in its sour taste. As such, it is acidic, astringent and antiscorbutic. The ripe fruit is full of sugar. The ripe mango is antiscorbutic, diuretic, laxative, invigorating, fattening and astringent. It tones up the heart muscle, improves complexion and stimulates appetite. Eating ripe mangoes in a season provides enough Vitamin A to last a whole year possibly.The mango kernel or seed contains over 8% protein besides other vitamins and minerals. Dried mango powder and the bark of the mango tree are astringent and useful in treatment of many ailments. The gum is used in dressing kibes and scabies. It is also considered anti-syphilitic.

The best-described property of almost every group of flavonoids is their capacity to act as antioxidants. The flavones and catechins seem to be the most powerful flavonoids for protecting the body against reactive oxygen species.Reactive oxygen species is proposed to be involved in carcinogenesis (Poulsen, 1996; Pryor, 1997).

Pharmacological Evidence

International Agency for Research on Cancer decided that there was sufficient evidence for cancer-preventive activity of beta-carotene in experimental animals. A number of mechanisms have been proposed for carotenoid interference in the carcinogenic process. Most actively researched have been their antioxidant effects, especially with respect to in vivo markers of lipid peroxidation in humans. Although beta-carotene supplementation has produced modest reductions in some of these biomarkers but not others (International Agency for Research on Cancer, 1998), their meaning for cancer evention is unclear. More relevant are biomarkers for oxidative DNA damage, since such damage can lead to point mutations in the initiation, promotion, or progression of carcinogenesis (Arab et al.,, 2001). The protective effect of fruit and vegetable consumption on cancer risk observed in epidemiologic studies may have been the result of another nutrient or phytochemical or a combination of phytochemicals in fruits and vegetables rather than beta-carotene alone (Mayne et al., 1998; Robert et al., 2001).

Mangoes in Ayurveda

Mango is extensively used in Ayurvedic cures. Mangoes have the properties of good for excess wind (vata) and mucus (kapha). A ripe mango helps the body to generate blood. If a glass of lukewarm milk is taken after eating a ripe mango then it energizes the entire system, especially the intestines. Mango increases the seven dhatus. It cleanses the body by eliminating toxins. It cures constipation. The emergence of boils on the body after eating mangoes indicates the cleansing action of mangoes. It is a good cure for loss of weight. This fruit checks premature aging.

Health Benefits and Curative Properties

Heat Stroke

Boil raw mangoes in water till cooked. Extract the juice, and mix with sugar, water, salt and a pinch of cumin seeds. Drink this consistently in the hot summer, especially when you suffer a heat stroke or get prickly heat.

Digestion

Aamchur or sun-dried raw mango powder is great to aid the digestive system. Eating one or two small tender mangoes in which the seed is still not fully formed, with salt and honey is an effective medicine for summer diarrhea, dysentery, piles, morning sickness, chronic dyspepsia and indigestion.

Blood Disorders

Raw mangoes increase the elasticity of the blood vessels, and help the formation of new blood cells. It aids absorption of food iron. It increases resistance against TB, anemia, cholera and dysentery.

Bilious Disorders

The acids contained in the green mangoes increase the secretion of bile and act as an intestinal antiseptic. Have it with honey and black pepper daily. This paste is also good for toning the liver.

Eye Disorders

Mango Milkshakes are very good for the eyes, due to Vitamin A. Night blindness, dryness of the eyes, itching and burning of the eyes.

Loss of weight

Mango with milk, or preferably, Soya milk gives an ideal mixture of sugar and protein for under-weight people.Consuming this three times a day for a month will lead to better health, weight gain and vigor.

Diabetes

The tender leaves of the mango tree are used to prevent and control early symptoms of diabetes. Soak the fresh leaves in water overnight and squeeze them in water before straining it the next morning. Alternatively, these leaves should be dried, powdered and preserved. Take half a teaspoon of this powder twice a day.

Spleen enlargement, dysentery and diarrhea

The mango stone should be dried and powdered. (you may do the same with the jamun seeds). Mix this powder with a big tablespoon of curd to cure spleen enlargement, dysentery and diarrhea.

Throat disorder

The mango bark is very effective in the treatment of diphtheria and other throat diseases.
Gum inflammation. Boil two tablespoons of mango flowers and tender buds in two cups of water and use as a mouth-wash regularly to cure the infammation of the gums

Skin disorders

The gum of the mango tree and the resinous substance exuded from the stem end of the fruits can be mixed with lime juice and use to heal coetaneous infections and scabies.
So, amazingly, almost every part of the mango tree is used to cure common diseases. So, here, like the coconut tree, we have a mango tree which has immense practical use in our daily lives.

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2. BANANA (*Musa sp.*)

Banana belongs to the family Musaceae and genus *Musa*. There are several species of Musa which involves both depoilds and triploids. Most of the cultivated bananas are triploids. They are further classified based on their genomic status. Bananas and plantains are today grown in every humid tropical region and constitute the 4th largest fruit crop of the world, following the grape, citrus fruits and the apple. India is the largest producer of the banana in the world with over 23 million tonnes. It is called 'Kalpatharu' as almost every part of the plant is used for one or the other purpose.

Uses

Banana is the cheapest, plentiful and most nourishing of all fruits. It contains nearly all the essential nutrients including minerals and vitamins and has several medicinal properties. Banana is a rich source of energy. About 24 bananas each weighing around 100gm would provide the energy requirement (2400cal/day) of a sedentary man. Besides as a fresh fruit it is also used in beverages, icecreams, confectionary and baby foods. Culinary bananas are also used for making various kinds of traditional foods in various parts of the world.

Nutritional Composition fo bananas

Component	Quantity per 100 g	Component	Quantity Per 100 g
Energy	116 Kcal	Riboflavin	0.08
Protein	1.2g	Vitamin C	7 mg
Fat	0.3 g	Thiamine	0.05 mg
Carbohydrates	27 g	Niacin	0.5 mg
Ash	0.9 g	Calcium	17 mg
Crudefibre	0.5 g	Iron	0.9 mg
Carotene	78 ug	Phosphorus	36 mg

Gopalan *et al.,* 1985

Phytochemicals

The major compounds revealed from the sap of banana accessions, namely, Musa balbisiana , Musa laterita , Musa ornata , and Musa acuminata , and some cultivars were apigenin glycosides, myricetin glycoside, myricetin-3-O-rutinoside, naringenin

glycosides, kaempferol-3-O-rutinoside, quercetin-3-O-rutinoside, dopamine, and N-acetylserotonin. The results indicated that there was a variety of phenolic and aromatic amino contents in many banana species. These compounds were reported to relate with biological activities (Pathovon *et al.,*2010).

In a study conducted on antioxidant activity of water extracts of banana peel it was comparable to those of synthetic antioxidants such as butylated hydroxyanisole andbutylated hydroxytoluene. Among all isolated components ß-sitosterol, malic acid, succinic acid, palmatic acid, 12-hydroxystrearic acid, glycoside, the d-malic and 12-hydroxystrearic acid were the most active against all the Gram-negative and positive bacterial species tested (Mokbel and Fumio, 2005).

Dopamine is a strong water-soluble antioxidant identified in the popular commercial banana *Musa cavendishii*. It had greater antioxidative potency than glutathione, food additives such as butylated hydroxyanisole and hydroxytoluene, flavone luteolin, flavonol quercetin, and catechin, and similar potency to the strongest antioxidants gallocatechin gallate and ascorbic acid. Banana contain dopamine at high levels in both the peel and pulp. Dopamine levels range from 80−560 mg per 100 g in peel and 2.5−10 mg in pulp, even in ripened bananas ready to eat. Banana is thus one of the antioxidative foods (Kanawaza and Hiroyuki,2000) .

Pharmacological Evidence

Fruit are rich sources of a variety of nutrients, including vitamins, trace minerals, and dietary fiber, and many other classes of biologically active compounds. These phytochemicals can have complementary and overlapping mechanisms of action, including modulation of detoxification enzymes, stimulation of the immune system, reduction of platelet aggregation, modulation of cholesterol synthesis and hormone metabolism, reduction of blood pressure, and antioxidant, antibacterial, and antiviral effects. Although these effects have been examined primarily in animal and cell-culture models, experimental dietary studies in humans have also shown the capacity of vegetables and fruit and their constituents to modulate some of these potential disease-preventive mechanisms. The human studies have relied on intermediate endpoints related to disease risk (Lampe, 1999).

Therapeutic and Curative Properties of Banana

Banana is good for several common ailments and has many health benefits

- Soothes the stomach. Good for dyspepsia (upset stomach).
- Strengthens the stomach lining against acid and ulcers.
- Has antibiotic activity

Anaemia: High in iron, bananas can stimulate the production of hemoglobin in the blood and so helps in cases of anaemia.

Blood Pressure: This unique tropical fruit is extremely high in potassium yet low in salt, making it the perfect food for helping to beat blood pressure. So much so, the US Food and Drug Administration has just allowed the banana industry to make official claims for the fruit's ability to reduce the risk of blood pressure and stroke.

Brain Power: 200 students at an English school were helped through their exams this year by eating bananas at breakfast, break and lunch in a bid to boost their brain power. Research has shown that the potassium-packed fruit can assist learning by making pupils more alert.

Constipation: High in fibre, including bananas in the diet can help restore normal bowel action, helping to overcome the problem without resorting to laxatives.

Depression: According to a recent survey undertaken by MIND amongst people suffering from depression, many felt much better after eating a banana. This is because bananas contain tryptophan, a type of protein that the body converts into serotonin - known to make you relax, improve your mood and generally make you feel happier.

Hangovers: One of the quickest ways of curing a hangover is to make a banana milkshake, sweetened with honey. The banana calms the stomach and, with the help of the honey, builds up depleted blood sugar levels, while the milk soothes and re-hydrates your system.

Heartburn: Bananas have a natural antacid effect in the body so if you suffer from heart-burn, try eating a banana for soothing relief.

Morning Sickness: Snacking on bananas between meals helps to keep blood sugar levels up and avoid morning sickness.

Mosquito bites: Before reaching for the insect bite cream, try rubbing the affected area with the inside of a banana skin. Many people find it amazingly successful at reducing swelling and irritation.

Nerves: Bananas are high in B vitamins that help calm the nervous system.

Overweight and at work? Studies at the Institute of Psychology in Austria found pressure at work leads to gorging on comfort food like chocolate and crisps. Looking at 5,000 hospital patients, researchers found the most obese were more likely to be in high-pressure jobs. The report concluded that, to avoid panic-induced food cravings, we need to control our blood sugar levels by snacking on high carbohydrate foods (such as bananas) every two hours to keep levels steady.

PMS: Forget the pills - eat a banana. The vitamin B6 it contains regulates blood glucose levels, which can affect your mood.

Seasonal Affective Disorder (SAD): Bananas can help SAD sufferers because they contain the natural mood enhancer, trypotophan.

Smoking: Bananas can also help people trying to give up smoking, as the high levels of Vitamin C, A1, B6, B12 they contain, as well as the potassium and magnesium found in them, help the body recover from the effects of nicotine withdrawal.

Stress: Potassium is a vital mineral, which helps normalise the heartbeat, sends oxygen to the brain and regulates your body's water-balance. When we are stressed, our metabolic rate rises, thereby reducing our potassium levels. These can be re-balanced with the help of a high-potassium banana snack.

Strokes: According to research in "The New England Journal of Medicine"eating bananas as part of a regular diet can cut the risk of death by strokes by as much as 40%!

Temperature control: Many other cultures see bananas as a "cooling" fruit that can lower both the physical and emotional temperature of expectant mothers. In Thailand, for example, pregnant women eat bananas to ensure their baby is born with a cool temperature.

Ulcers: The banana is used as the dietary food against intestinal disorders because of its soft texture and smoothness. It is the only raw fruit that can be eaten without distress in over-chronic ulcer cases. It also neutralises over-acidity and reduces irritation by coating the lining of the stomach.

Warts: Those keen on natural alternatives swear that, if you want to kill off a wart, take a piece of banana skin and place it on the wart, with the yellow side out. Carefully hold the skin in place with a plaster or surgical tape!

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CITRUS

Citrus is one of the most important fruit crops of the world. The most important commercial citrus fruits in India is mandarin oranges followed by sweet oranges, lemons and acid limes.

3. Sweet Oranges (*Cirus sinensis* Osbeck)

One of the most widely favored of the world's fruits, the orange, sweet orange, or round orange, was for many years known as *Citrus aurantium* var. *sinensis* L. and considered to be a form of the sour orange (q.v.). It is still not universally agreed to be a distinct species, C. *sinensis* Osbeck, but it is usually treated as though it were.

USES

In the past, oranges were primarily eaten fresh, out-of-hand, and many are so consumed in warm climates. The juice may be extracted and consumed or it may be concentrated and frozen. In Cuba, oranges are peeled by an old-fashioned apple peeler mounted on the pushcart of fruit vendors. In the home, oranges are commonly peeled, segmented and utilized in fruit cups, salads, gelatins and numerous other desserts, and as garnishes on cakes, meats and poultry dishes.Pectins are extracted from the peel also.

Nutritional Composition of Oranges

Constituents	Fruit (fresh)	Juice (fresh)*	Juice (canned, unsweetened, undiluted)	Frozen concentrate (unsweetened, undiluted)	Juice (dehydrated)	Orange Peel (raw)**
Calories	47-51	40-48	223	158	380	
Moisture	86.0 g	87.2-89.6 g	42.0 g	58.2 g	1.0 g	72.5%
Protein	0.7-1.3 g	0.5-1.0 g	4.1 g	2.3 g	5.0 g	1.5 g
Fat	0.1-0.3 g	0.1-0.3 g	1.3 g	0.2 g	1.7 g	0.2 g
Carbohydrates	12.0-12.7 g	9.3-11.3 g	50.7 g	38.0 g	88.9 g	25.0 g
Fiber	0.5 g	0.1 g	0.5 g	0.2 g	0.8 g	
Ash	0.5-0.7 g	0.4 g	1.9 g	1.3 g	3.4 g	0.8 mg
Calcium	40-43 mg	10-11 mg	51 mg	33 mg	84 mg	161 mg

Phosphorus	17-22 mg	15-19 mg	86 mg	55 mg	134 mg	21 mg
Iron	0.2-0.8 mg	0.2-0.3 mg	1.3 mg	0.4 mg	1.7 mg	0.8 mg
Sodium	1.0 mg	1.0 mg	5 mg	2 mg	8.0 mg	3.0 mg
Potassium	190-200 mg	190-208 mg	942 mg	657 mg	1,728 mg	212 mg
Vitamin A	200 I.U.	200 I.U.	960 I.U.	710 I.U.	1,680 I.U.	420 I.U.
Thiamine	0.10 mg	0.09 mg	0.39 mg	0.30 mg	0.67 mg	0.12 mg
Riboflavin	0.04 mg	0.03 mg	0.12 mg	0.05 mg	0.21 mg	0.09 mg
Niacin	0.4 mg	0.4 mg	1.7 mg	1.2 mg	2.9 mg	0.9 mg
Ascorbic Acid	45-61 mg	37-61 mg	229 mg	158 mg	359 mg	136 mg

Phytochemicals

Bermejo et al (2011) analyzed th chemical content in peels of fruits belonging to cultivars of Clementine mandarin (Fino, Loretina and Marisol), Satsume mandarin (Owari), Navel orange (Navelate and Navelina) and Common orange (Valencia Late). Rind contents showed similar tendencies for the majority of compounds although Satsume group presented the highest amounts on the flavanone glycosides hesperidin and narirutin, as well as the highest amounts of the carotenoid and β-cryptoxanthin, comparing with the remaining varieties studied. Both mandarin and orange varieties studied showed similar tendencies concerning to other phenolic compounds and total ascorbic acid concentrations. Limonene was the most abundant peel essential oil in all cultivars studied, followed by myrcene. Calcium and potassium were the dominant macronutrients for each cultivar studied, although the proportion of the individual nutrients ranged among different cultivars.

The antioxidant efficiency of orange juices may be attributed, in a significant part at least, to their content of total phenols, (2) while ascorbic acid seems to play a minor role; (3) the antioxidant activity of orange juices is related not only to structural features of phytochemicals contained in them, but also to their capability to interact with biomembranes; (4) finally, as to pigmented juices, their antioxidant efficiency appears to be widely influenced by the anthocyanin level (Rapisarda et al, 1999).

Pharmocological Evidence of medicinal properties of oranges

Fruit intake has been reported to protect against CVD. Fruit contains vitamins (such as vitamin C and folate), carotenoids, flavonoids, potassium, and fiber. Reports have shown that these protect against hypertension (Trout, 1991; He and MacGregor,

2001) and atherosclerosis by inhibiting low-density lipoprotein oxidation, (Savige, 2001) preventing increases in homocysteine and platelet aggregation,3,4 and improving glucose intolerance (He and MacGregor, 2001) High fruit intake has also been associated with reduced CVD mortality and incidence.

Health Benefits and Curative Properties

Oranges are eaten to allay fever and catarrh. The roasted pulp is prepared as a poultice for skin diseases. The fresh peel is rubbed on acne. In the mid-1950s, the health benefits of eating peeled, whole oranges was much publicized because of its protopectin, bioflavonoids and inositol (related to vitamin B). The orange contains a significant amount of the vitamin-like glucoside, hesperidin, 75-80% of it in the albedo, rag and pulp. This principle, also rutin, and other bioflavonoids were for a while much advocated for treating capillary fragility, hemorrhages and other physiological problems, but they are no longer approved for such use in the United States(Morton, 1987a).

An infusion of the immature fruit is taken to relieve stomach and intestinal complaints. The flowers are employed medicinally by the Chinese people living in Malaya. Orange flower water, made in Italy and France as a cologne, is bitter and considered antispasmodic and sedative. A decoction of the dried leaves and flowers is given in Italy as an antispasmodic, cardiac sedative, antiemetic, digestive and remedy for flatulence. The inner bark, macerated and infused in wine, is taken as a tonic and carminative. A vinous decoction of husked orange seeds is prescribed for urinary ailments in China and the juice of fresh orange leaves or a decoction of the dried leaves may be taken as a carminative or emmenagogue or applied on sores and ulcers. An orange seed extract is given as a treatment for malaria in Ecuador but it is known to cause respiratory depression and a strong contraction of the spleen (Morton, 1987a).

4. Lime (*Citrus aurantifolia*, L.)

Acid limes are excellent source of free citric acid, natural sugar, vitamin C, calcium and phosphorus. It contains by far more vitamin C than the lemon. It is generally used for its juice which is taken in various ways. The best way to use it is to take with water. The lime juice forms an indispensable ingredient of salads. In fruit salads, it helps to retain the normal color of fruits and imparts tart flavor. It is often mixed with cooked pulses, soups, sauces and gravies to make them more tasty and palatable. Juice of lime and lemon is used in squashes and cordials.

Nutritional Composition of Lime

Constituents	Quantity
Moisture	84.6 g/100 g
Carbohydrates	10.9 g/100 g
Protein	1.5 g/100 g
Fat	1.0 g/100 g
Minerals	0.7 g/100 g
Fibre	1.3 g/100 g
Calcium	90 mg /100 g
Phosphorus	20 mg /100 g
Iron	0.3 mg /100 g
Vitamin C	63 mg /100 g

Natural Benefits and Curative Properties

The juice of fresh limes is being used in medicine from ancient times in India. In *Vadas,* lime has been mentioned as a sacred fruit. Cutting limes after reciting certain *Mantras* is considered an effective method for driving away the evil spirits. Charaka and Sharangdhara, the two famous physicians of ancient India, have mentioned about the therapeutic value of lime in various diseases of bones and joints. The vitamin C content in lime increases the body's resistance to disease, aids the healing of wounds and prevents damage to the eyes. Vitamin C is also helpful in maintaining the health of the teeth and other bones of the body. It prevents decay and loosening of the teeth, dental caries, toothache, bleeding of the gums and fragility of bones.

The rind of the fruit also has medicinal properties. It contains a volatile oil which is used in medicine for improving digestion and removing wind

- **Scurvy** :- As a rich source of vitamin C, the lime has been regarded as a food of exceptional therapeutic value. It has saved the lives of innumerable crews of ocean-going vessels from scurvy. The Boards of Trade regulations have made it compulsory for the crew to have a supply of lime juice when vegetables are not available.

Digestive Disorders :- Lime is considered highly beneficial in the treatment of digestive disorders. A teaspoonful of fresh lime-juice should be mixed with equal quantity of honey. It should be licked to stop bilious vomiting, indigestion, burning in the chest due

to high acidity in the stomach and excessive accumulation of saliva in the mouth.
A teaspoonful of lime juice mixed with water and a pinch of soda bicarb makes an excellent remedy for reducing the acidity in the stomach. It also acts as a powerful carminative in case of indigestion. It produces a marked sedative effect in the stomach due to release of carbonic acid gas.

Constipation :- The lime juice is of great value in constipation, when it is taken as the first thing in the morning in a glass of warm water. In chronic cases, it helps remove tire disorder by promoting biliary secretion from liver.

- **Peptic Ulcers** :- The citric acid in limes has an alkaline reaction in the system. This acid together with the mineral salts present in the juice, helps the digestion by assisting in the absorption of fats and alcohol and by neutralizing excessive bile produced by the liver. The juice counteracts the effects of greasy food and reduces gastric acidity. It is, therefore, specially valuable in the treatment of peptic ulcers.

Common Cold :- Lime is ideal in alt types of fevers and cold if taken weltdiluted. Vitamin C rich lime juice increases resistance, reduces toxicity and cuts down the course of the illness. Unless one is specially allergic to citrus fruits, one should not avoid lime in cold. A glass of diluted lime juice prepared in warm water, to which a teaspoonful of honey is added, is an ideal remedy for cold and dry cough.

Tonsillitis :- Lime has proved effective in the treatment o(acute tonsillitis. A fresh lime squeezed in a glass of warm water, with four teaspoonful of honey and a quarter teaspoonful of common salt, should be sipped slowly in such cases.

- **Gums** :- Lime is valuable in swollen gums. A glass of diluted fresh lime juice mixed with a pinch of rock salt should be taken in this condition. The squeezed lime rind should also be rubbed over the gums, before throwing it away.

Eye Disorders :- Lime juice is valuable in eye disorders. Few drops of warm lime-juice diluted with water should be instilled in the eyes in case of conjunctivitis. Its regular use with pure rose water in the ratio of 1:4 is helpful in preventing old-age cataract.

- **Cystitis** :- Lime has proved valuable in cystitis - ie., inflammation of urinary bladder. A teaspoonful of lime juice should be put in 180 gm. of boiling water. It should then be allowed to cool and 60 gm. of this water should be given eVery two hours in this condition. It gives relief to burning sensation and also stops bleeding in cystitis.

- **Scorpion Sting** :- When externally applied, fresh lime is highly beneficial in the treatment of scorpion sting. A crystal of potassium permanganate should be put over it. It will have effect in ten minutes.

Obesity :- The lime juice is also excellent for weight reduction. It has a sedative effect on the nerves. Fresh juice' of a lime mixed in a glassful of water and sweetened with honey

should be taken every morning on empty stomach in case of obesity. It will reduce the weight in two to three months time. One should however, take low calorie diet to get the desired result.

5. Lemon (*Citrus limon* Burm)

The leading acid citrus fruit, because of its very appealing color, odor and flavor, the lemon, *Citrus limon* Burm. f. (syns. C. *limonium* Risso, C. *limonia* Osbeck, *C. medica* var. *limonium* Brandis), is known in Italy as *limone.* Several lemon-like fruits are domestically or commercially regarded as lemons wherever they are grown. These include: Rough lemon (C. *jambhiri* Lush.), Sweet lemon *(C. limetta* Risso), 'Meyer' (lemon X mandarin hybrid); 'Perrine' (lime X lemon hybrid); 'Ponderosa' (presumed lemon X citron hybrid), qq.v. under "Varieties" (Morton, 1987b).

Uses

Culinary Uses

Lemon is widely used for making pickles in India. Pickled lemons are also famous in Morocco.Lemon juice, rind, and zest are used in a wide variety of culinary applications:

Lemon juice is used to make lemonade, soft drinks, and marinades for both fish, where its acid neutralizes amines in fish by converting them into nonvolatile ammonium salts, and meat, where the acid partially hydrolyzes tough collagen fibers, tenderizing the meat, but the low pH denatures the proteins, causing them to dry out when cooked.

- Lemon juice is also used as a short-term preservative on certain foods that tend to oxidize and turn brown after being sliced, such as apples, bananas and avocados, where its acid denatures the enzymes which cause browning and degradation. Lemon juice and rind are used to make marmalade and lemon liqueur.
- Lemon slices and lemon rind are used a garnish for both food and drinks.
- Lemon zest, the grated outer rind of the fruit, is used to add flavor to baked goods, puddings, rice and other dishes.

Non-culinary uses

Aromatherapy, first aid and medicine

- In one of the most comprehensive scientific investigations done yet, researchers at The Ohio State University revealed lemon oil aroma used in aromatherapy does not influence the human immune system, but may enhance mood. The low pH of juice makes it antibacterial.

Commercial use

- Lemons were the primary commercial source of citric acid prior to the development of fermentation-based processes.
- A halved lemon is used as a finger moistener for those counting large amounts of bills, such as tellers and cashiers.

Household use

- The peel oil is used as a wood cleaner and polish, where the solvent property of *d*-limonene is employed to dissolve old wax, fingerprints, and grime.
- A halved lemon dipped in salt or baking powder can be used to brighten copper cookware. The acid dissolves the tarnish and the abrasives assist the cleaning.
- As a sanitary kitchen deodorizer the juice can deodorize, remove grease, bleach stains, and disinfect; when mixed with baking soda, it can remove stains from plastic food storage containers.

Nutritional Composition of Lemon

Particulars	Quantity
Moisture	85.0%
Carbohydrates	11.1%
Protein	1.0%
Fat	0.9%
Minerals	0.3%
Fibre	1.7%
Calcium	70 mg /100 g
Phosphorus	10 mg /100 g
Iron	2.3 mg /100 g
Vitamin C	39 mg/100 g

Source : http://en.wikipedia.org/wiki/Lemon

Phytochemicals in Lemon

Lemon contains various kinds of phytochemicals like Limonin, Limonin 17-ß-D-glucopyranoside, Limonin carboxymethoxime and Deoxylimonin. These have

prophylactic function and curative properties in preventing the diseases like cancer. Lemonoid glucosides are present in high concentration in all citrus fruits. They also contain certain growth promoting compounds like Naringin and Hesperetin. Citrus alos is a rich source of Pectin which have several health henefits. Modified Citrus Pectin (MCP) prevent cancer metastasis, inhibiting cancer cell proliferation. The pectins also has hypoglycemic , hypocholesterolemic, hemostasis, modulate human immune function and detoxification effects. The evidence suggests that antioxidants or bioactive compounds are best acquired through whole-food consumption, not from expensive dietary supplements. We believe that a recommendation that consumers eat 5 to 10 servings of a wide variety of fruits and vegetables daily is an appropriate strategy for significantly reducing the risk of chronic diseases and to meet their nutrient requirements for optimum health. (Source : http://phytochemicals.tamu.edu/ accessed on 14.04.2011).

Pharmacological Evidence of medicinal properties of citrus fruits

Oxidative stress and inflammatory responses sustained for a long period of time cause many diseases. A proinflammatory cytokine, tumor necrosis factor α (TNF-α), plays a pivotal role in the pathogenesis of chronic and auto-immune diseases. Intake of polyphenols contained in natural sources, such as hydroxytyrosol, tyrosol, oleuropein (olives), naringin and hesperidin (Citrus fruits), resveratrol, procyanidins or oligomeric procyanidin (grapes or grape seed extracts), (-)-epigallocatechin gallate (green tea) and quercetin (grapes, green tea) etc., are able to modulate chronic inflammatory diseases, such as type 2 diabetes, rheumatoid arthritis, inflammatory bowel disease, and affect the formation and interaction of advanced glycation end products with their respective receptors (Kawaguchi et al, 2011; Lee et al, 2011; Rizza et al, 2011). Dietary supplements containing antioxidants from various natural source including citrus flavonoids has shown the inhibition of cell proliferation of the highly invasive human hormone refractory (independent) PC-3 prostate cancer cells in a dose- and time-dependent manner. DNA-microarray analysis demonstrated that it inhibits proliferation through the modulation of expression of CCND1, CDK4, CDKN1A, E2F1, MAPK6 and PCNA genes. In addition, it also suppresses metastatic behavior of PC-3 by the inhibition of cell adhesion, cell migration and cell invasion, which was associated with the down-regulation of expression of CAV1, IGF2, NR2F1, and PLAU genes and suppressed secretion of the urokinase plasminogen activator (uPA) from PC-3 cells (Jiang et al, 2011; Steinbrecher et al, 1990).

Vitamin C in lemons have the same remarkable healing properties found in many citrus fruits. Vitamin C helps to neutralize and reduce the effect of free radicals that contribute to cancer and heart disease. Our body generates free radicals whenever we burn calories as fuel for our cells. We are also bombarded with free radicals from air pollution, tobacco smoke, radiation and sunlight.Vitamin C helps to build our body's immune system against free radicals (Naidu, 2003; Levin, 1986; Svirbely and Gyorgyi, 1932).

Lemons contain two compounds – **limonin and limonene** – which appear to help inhibit some of the cell divisions that may cause cancer. Limonene is found in the zest or outermost part of the rind of a lemon. This is the yellow part of the lemon which we often discard after extracting the lemon juice. The limonene found in the lemon peel or lemon zest has the effect of increasing the level of enzymes in the liver that may remove cancer-causing chemicals. The limonene has also been shown to remove estradiol, a hormone linked to breast cancer (Rui, 2004) .

Natural Benefits and Curative Properties

The various parts of the lemon used for medicinal purposes are rind of the ripe fruit, essential oil of the rind and expressed juice of the ripe fruit. A pale yellow volatile oil is derived either through distillation or by squeezing out from fresh outer part of the paricarp of the fruit. Though the oil is bitter yet it is highly valued in medicine as a flavoring agent, carminative that relives flatulence for treating gastric discomfort and stomachic that improves appetite.

- Rind is also both stomachic and carminative. Lemon juice, the expressed and strained juice of the ripe fruit, is valuable as anti scorbutic and refrigerant. It destroys the toxins in the body. This detoxifying property arises from its high potassium content. The germs of diphtheria, typhoid and other deadly diseases are destroyed by its use. The juice also encourages bile secretion and is valuable in jaundice and gravels-a condition of small stone in urinary tract. The bark of the lemon tree is used as febrifuge which prevents fever and seeds as a vermifuge which expels worms from intestine. Curative properties of lemon are as follows (http://phytochemicals.tamu.edu/accessed on 14.04.2011; http://righteatinghabits.com/2008/10/03/healing-properties-of-lemon-there-is-mo accessed on 14.04.2011.; http://www.best-home-remedies.com/herbal_medicine/fruits/lemon.htm) .

- **Scurvy** :- The lemon is chiefly valued for its vitamin C content. Its juice contains more vitamin than the whole fruit, being about 60 ml per 100 gram. The juice also contains appreciable quantity of vitamin B. This makes it anti scorbutic or an excellent food medicine for the prevention and treatment of scurvy. A mixture of one part of lemon juice, three parts of water and a desirable quantity of sugar or honey should be taken in this condition.

- **Oral Diseases** :- Due to its high content of vitamin C, lemon strengthens the gums and teeth. It is also very effective for preventing and curing acute inflammations of the gum margins, pyorrhea, dental caries and other oral diseases.

Throat Disorders :- Lemon is highly beneficial in the treatment of throat disorders such as catarrh, choking sensation and itching sensitivities. A ripe unpeeled lemon should be roasted slowly until it begins to crack open. Then one teaspoonful of the juice with a little

honey should be taken once every hour, or the same juice of the roasted lemon in a glass of boiled water should be taken flavored with honey. It should be sipped slowly.

- **Burning Soles and Heels** :- Sliced lemon should be rubbed over the entire burning soles and heals of feet. A great deal of toxin elimination takes place through the pores of the feet. Lemon application promotes such elimination and keep the feet free from pain and distress.

Digestive Problems :- A ripe lemon is a good appetizer. The lemon juice stimulates the flow of saliva and gastric juice and is regarded as an excellent digestive agent. It destroys intestinal worms and eliminates the gases formed in the digestive tract. It is highly beneficial in the treatment of several digestive problems like dyspepsia, constipation and biliousness. Heartburn is easily relieved by taking the juice of half a lemon in a little water.

Fevers :- Lemon juice makes an effective thirst-quenching drink in pox, measles, scarlet and other fevers which are attendant with extreme thirst and a very hot and dry skin. About 15 to 25 Km. of lemon juice should be taken in these conditions.

- **Hemorrhage** :- Lemon is effective in the hemorrhage or bleeding of lungs. stomach, intestines, uterus, kidneys and other internal organs. In these cases, lemon juice should be taken with water several times a day.

Obesity :- An exclusive lemon juice is an effective remedy for obesity. One the first day the patient should be given nothing but plenty of water. On the second day juice of three lemons mixed with equal amount of water should be given. One lemon should be subsequently increased each day until the juice of 12 lemons is consumed per day. Then the number of lemons should be decreased in the same order until three lemons are taken in a day. The patient may feel weak and hungry on first two days, but afterwards the condition will stabilise by itself.

Cholera :- Lemon has been provided by nature with wonderful anticholera properties. Lemon juice can kill cholera bacilli within a very short time. It is also a very effective and reliable preventive food item against cholera during the epidemic. For this purpose, it can be taken in the form of sweetened or salted beverages. Taking of lemon with food as a daily routine also saves from cholera.

- **Beauty Aid** :- Lemon is regarded as a youth restorative. It helps create youthful health. To help cleanse blemished skin, the area should be rubbed with a fresh piece of lemon. The juice should be soaked into the skin, allowing it to remain overnight. Strained fresh lemon juice mixed with cool water should be used to wash the hair to add to their brightness. Dry or scaly skin should be rubbed with the peel of a lemon. It will restore the skin to softness. Rough elbows can be soften by rubbing the area with the cut side of a lemon.

Corns :- Lemon is valuable in corns. A fresh slice of lemon should be tied over the painful area at night and it should be allowed to remain there whole night.

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6. GRAPES (*Vitis vinefera, L.*)

Grapes belongs to the Vitaceae and genus *Vitis*. The region between Black and Caspian Sea is considered to be the origin of grapes. It is presumed that it spread to India in 620 B.C. Grapes has several uses like table purpose, raisin making, juice purpose, for making wine, canning, etc. It has several medicinal and curative properties. It is used in Ayurvedic preparations for making Kada (herbal tonic or medicine).

Uses

The grapes which are used as a fresh fruit or for decorative purpose are designated as table grapes. These are having attractive appearance, and good eating and shipping quality and long self-life.The eating quantity includes the pleasant aroma, taste, texture of skin and pulp and seedlessness. The grapes that can be dried are included in the Raisin grapes. Wine grapes which are primarily used to produce wine are known as wine grapes. In many parts of the world , grapes are grown for wine preparation. Grapes with high acid and low sugars contents are suitable for wine preparation.

Nutritional Composition

Component	**Quantity**	**Component**	**Quantity (in ug/100) g)**
Water	70-80%	Thiamine	35-58
Organic acids	0.3-1.5%	Riboflovin	20-25
Carbohydrates	18.0%	Pyridoxin	84-135
Protein	0.7%	Pantothenic acid	78
Fat	0.1%	Nicotinic acid	170-330
Minerals	0.03-0.6%	Folic acid	4.20-10.20
Calcium	20 mg/100 g	Inositol	22-73
Iron	20 mg/100 g	Tannins	0.01-0.10 g/100g

(Bose,1985).

Phytochemicals

Grapes contain several phytochemical like Phenolic acids, Flavonols, Flavon-3-ols, Myricetin, Peonidin, Flavonoids, Resveratrol, Quercetin, Tannins, Anthocyanins,

Kaempferol, Cyanidin, Ellagic Acid, Proanthocyanidins which are responsible for its medicinal and curative properties (http://www.phytochemicals.info/plants/grape.php).

Pharmacological Evidence for medicinal properties

Grapes contain a wide variety of polyphenol compounds, including flavonoids, phenolic acids, and resveratrol. There is extensive epidemiological evidence suggesting that dietary intake of these compounds reduces cardiovascular mortality (Hertog et al, 1995; Kris-Etherton et al, 2002). These antioxidants acts as disease preventors by interfering in signal transduction as well as free radical scavenging. It is now understood that redox signaling is important for normal cellular physiology and the response to environmental stress. It remains clear, that "oxidative stress" has pathophysiological effects on enzyme function, cell signaling, and gene expression that contribute to disease development. Interventions that affect cellular redox status have the potential to reduce risk (Dohadwala and Vita, 2009). Hayek et al. (1997) observed that hypercholesterolemic mice consuming grape wine polyphenols for 6 wk had markedly less atherosclerosis than control animals. These treatments were associated with protection against LDL oxidation. Red wine and polyphenols were found to inhibit activation of nuclear factor-kB and productionof proinflammatory factors in endothelial cells and inflammatory cells (Carluccio et al, 2003) thereby preventing or alleviating the tissue inflammation.
Red grape leaves have been traditionally used to treat diarrhea, heavy menstrual bleeding and uterine hemorrhage.

Health Benefits and Curative Properties
(http://www.best-home-remedies.com/herbal_medicine/fruits/grapes.htm)

Constipation :- The combination of the properties of the cellulose, sugar and organic acid in the grape makes it a laxative food. It is highly valuable in relieving constipation. Its field of action is not limited in clearing the bowels only. It tones up the stomach and intestines and relieves the most chronic cases of constipation. One should take at least 350 grams of grapes daily to achieve the desired results. When fresh grapes are not available, raisins soaked in water can be used

- **Dyspepsia** :- Grapes are valuable in dyspepsia. They constitute a light. food which removes indigestion and irritation of the stomach in a short time and relieves heat.

- **Asthma :-** Grapes are considered useful in asthma.

- **Heart Disease** : - Grapes are highly beneficial in the treatment of heart disease. They tone up the heart and are effective in cardiac pain a£!d palpitation of the heart. The diseases can be rapidly controlled if the patient adopts an exclusive grape diet for few days. Grape juice will be valuable when one is actually suffering from a heart attack. This will avert serious consequences by reducing the pain and palpitation.

- **Migraine** :- The juice of ripe grapes is a very effective home remedy for migraine

- **Kidney Troubles :-** The grape has an exceptional diuretic value on account of its high contents of water and potassium salt. Its value in kidney troubles is enhanced by its low albumin and sodium chloride content. It is an excellent food remedy in acute and chronic nephritis and in kidney and bladder stones.

- **Liver Disorders** :- Grapes activate the liver or hepatic functions to stimulate glycogenic functions and bile secretion They are thus highly beneficial in the treatment of all liver disorders.

- **Children's Diseases** :- Grape juice is excellent blood-builder. It is an effective household remedy and can be preserved in bottles. It is valuable to children in the treatment of constipation and also in the prevention of convulsions due to constipation. The juice is an effective food remedy for infants during teething trouble.

- **External Sores** :- Grape poultices have been found effective in case of external growths, where there is an open sore. The poultice is prepared by crushing grapes and spreading them between layers of cheese cloth or muslin It should be placed over the affected parts and covered with a dry cloth The poultice should be renewed frequently as it absorbs much of the toxins.

- **Pyorrhea :-** The organic acids of the grapes are strongly antiseptic and their effect on the gums is very effective According to Johanna Brandt, "Every tooth may be loose in its socket and pus may be pouring from the gums, but after a few weeks on the exclusive grape diet it wil1 in time be found that the teeth are firmly set in the jaws and that every trace of pyorrhea poisoning has disappeared".

- **Alcoholism** :- Grapes are highly beneficial in the treatment of alcoholism. It is a very effective remedy for those craving for alcoholic drinks as it supplies the purest form of the alcohol. Grapes should form an exclusive diet in treating the alcoholics.

- **Fatigue:** Light and white grape juice replenishes the iron content present in the body and prevents fatigue. Though, the dark grape juice might not give an iron boost and on the other hand, decrease the iron levels. Drinking grape juice also provides you with instant energy. The anti-oxidants present in grapes also provide the needed boost to your immune system.

- **Breast** cancer**:** Through a latest study, it has been discovered that purple colored Concord grape juice helps in preventing breast cancer. Significant reduction in mammary tumor mass of laboratory rats was seen after they were fed the grape juice on the experimental basis.

Alzheimer's disease: Resveratrol, a beneficial polyphenol present in grapes reduces the levels of amyloidal-beta peptides in patients with Alzheimer's disease. Studies suggest that grapes can enhance brain health and stall the onset of neurodegenerative diseases.

- **Macular degeneration:** Grapes can prevent the age related loss of vision or macular degeneration. Three servings of grapes a day can reduce the risks of macular degeneration by over 36 %.

- **Prevents cataract:** Flavonoids present in grapes have antioxidants, which can reduce and fight the damage caused by free radicals such as cataract apart from cardiovascular diseases, cancer, and age related problems.

- **Blood cholesterol:** Grapes contain a compound called pterostilbene, which has the capacity to bring down cholesterol level. Saponins present in grape skin can also prevent the absorption of cholesterol by binding with it.

- **Antibacterial activity:** Red grapes have strong antibacterial and antiviral properties and can protect you from infections. They have a strong antiviral property against poliovirus and herpes simplex virus.

- **Anticancer properties:** Grapes are found to have strong anti cancer properties due to the anti-inflammatory effect of resveratrol present in grapes. It is particularly effective in colorectal cancer and breast cancer. Anthocyanins and proanthocyanidins present in grapes have properties of an anti-proliferate and can inhibit the growth of cancer causing agents. Grape juice not just prevents the risk of cancer but also suppresses the growth and propagation of cancer cells. The pigments contained in grapes enhance the overall immunity of the body.

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7. LITCHI (*Litchi chinensis* Sonn.)

The Litchi (lychee) is the most renowned of a group of edible fruits of the soap berry family, Sapindaceae. It is botanically designated *Litchi chinensis* Sonn. *(Nephelium litchi* Cambess) and widely known as litchi and regionally as *lichi, lichee, laichi, leechee* or lychee. **Litchi** is a tropical fruit tree native to southern China. It is also commonly found in Madagascar, India (Muzaffarpur), Bangladesh, Pakistan, southern Taiwan, northern Vietnam, Indonesia, Thailand, the Philippines, and Southern Africa. It is a Medicinal plants, provide meaningful inputs for drugs. Great source of Vitamin C and potassium, it also contain phosphorous, calcium, magnesium and protein.

Uses

Litchi is commonly used as a table fruit, but in China, it is very popular in dried or canned state. A highly flavored squash is also prepared from the fruit. Pickles preserved and wines are also made from litchi. The Chinese use the leaves for making poulice; the seed is anodyne for the skin, and flowers, bark and roots are used for making decoction for throat gargle.

Nutritional Composition of Litchi

Component	Quantity	Component	Quantity
Moisture	80%	Phosphorus	41.0 mg /100 g
Carbohydrates	17.5%	Iron	1.3 mg/100g
Protein	1.1%	Thiamine	0.05 mg/100g
Fat	0.1%	Riboflavin	0.07 mg/100g
Fibre	0.1g%	Niacin	0.5 mg/100g
Calcium	7 mg /100 g	Ascorbic acid	49 mg/100g

(Bose et al, 1985)

Phytochemicals in Litchi

Litchi fruit is an antioxidant fruit. Nutrients contained in fruit is protein, carbohydrate, crude fiber, vitamin C and minerals (calcium, phosphorus and iron). In addition, fruit litchi also contains polyphenols compounds, namely corilagin, gallic acid and ellagic acid. These three compounds possess antioxidant property. Such compounds have the ability to ward off free radicals that can reduce oxidation in the body. The major phenolics in litchi fruit pericarp tissues were identified as epicatechin, procyanidin B4

and procyanidin B2 (Duan et al, 2007). Zhang *et al*. (2000) have reported that the phenolic constituents of litchi fruit pericarp are mainly epicatechin, epicatechin 3-gallate and procyanidin B2, while Sarni-Manchado *et al*. (2000) have mentioned condensed tannins, epicatechin and procyanidin A2 as the major phenolic compounds found in litchi fruit pericarp.

Benefits of litchi fruit more derived from the seeds and fruits than meat. Litchi seeds can be used as a skin bleaching, because it contains substances that can inhibit the activity of the enzyme tyrosinase. This enzyme has a function to change the melamine or skin pigment. Fle brown on the skin caused by the activity of the enzyme tyrosinase. If the action of the enzyme is high, then the brown spots on the skin will be more and more.

Pharmacological Evidence

A study indicated that Llichi Flower Water Extract had protective effect on cardiovascular health in vivo (Yang et al, 2010). Duan et al, (2007) reported that Litchi phenolics exhibited excellent antioxidant activity. They significantly inhibited the peroxidation of linoleic acid, and acted as a strong electron-donating agent in the Fe^{3+} to Fe^{2+} assay and a hydrogen-donating agent in the DPPH· assay. Furthermore, the phenolics from litchi pericarp tissues were effective in scavenging superoxide anion radicals and inhibiting deoxyribose degradation induced by hydroxyl radicals, mainly via chelation of iron ion. In addition, exogenous treatment with litchi phenolics significantly delayed increase in electrolyte leakage and prevented pericarp browning of the fruit, which may be attributed to a strong antioxidant activity.

Health Benefits and Curative Properties of Lithci (Lychee).

With nutritional content, the benefits of litchi fruit to increase stamina and endurance, increase appetite, aid digestion, intestinal worms overcome disease, cure of hernia, leucorrhoea, strengthen spleen, promote and launch the red blood cells. The fruit is also very good to maintain eye health, intestinal health and helps absorption of nutrients by the body (Nishihira et al, 2009; Besra et al, 1996; Souza et al, 2007; Deng et al, 2010).

In addition to fruit, other parts of the tree litchi can also be used as a medicine. The leaves are useful to cure sore and cope with high fever, whereas the roots of litchi trees are useful in blood flow in urine. The content of minerals and phytochemicals in fruits litchi also useful as a sedative and maintaining heart health (Deng et al, 2010). The Chinese healers used the fruit litchi in helping patients cope with nervous tension, palpitations, and cardiac abnormalities. In a number of studies have also found benefits of litchi fruit in helping to overcome anxiety, insomnia, impaired concentration, as well as to relax the nerves.

In China, the seeds are credited with an analgesic action and they are given in neuralgia and orchitis. A tea of the fruit peel is taken to overcome smallpox eruptions and

diarrhea. In India, the seeds are powdered and, because of their astringency, administered in intestinal troubles, and they have the reputation there, as in China, of relieving neuralgic pains. Decoctions of the root, bark and flowers are gargled to alleviate ailments of the throat. Lychee roots have shown activity against one type of tumor in experimental animals in the United States Department of Agriculture/National Cancer Institute Cancer Chemotherapy Screening Program (Morton, 1987).

1. Flesh of Lychee is used to treat cough and congestion.

2. Lychee flesh is also considered a good antacid; it is used to treat High acidity, Stomach Ulcers, and Gastro Intestinal illnesses like upset stomach, mild Diarrhea, Nausea etc.

3. Seeds of Lychee are said to have analgesic properties and is traditionally used to relieve pain by drinking tea made with powdered seeds or applying the ground seeds to various body parts to reduce swelling and pain.

4. The peeled skin also has its uses. Tea made by boiling these peels is used to help fight off common colds, throat infections, mild diarrhea and other common viral infections.

5. Similarly herbal tea made by boiling tree bark, roots, and flowers from lychee tree is used to fight common infections, chicken pox and boost body's immune system.

6. Traditionally in northern India powdered lychee seeds are taken to relieve intestinal troubles, it is also believed to help the body get rid of annoying and harmful intestinal worms.

7. Honey made by bees near lychee groves is also considered very healthy and good quality, with many medicinal uses.

- According to a Chinese book, the nature of the flesh of the lychee is warm and it can help improve the blood.

- The Chinese believe that lychee has the ability to relieve pain and shrink swollen glands.

- The health benefits of lychee fruit compliment the health benefits of the acai berry.

- Studies done conclude that the lychee fruit prevents the growth of cancer cells, particularly breast cancer. It is maybe due to the flavonoids content of the lychee pulp.

- Lychee is a rich source of vitamin C, a vitamin that the body does not produce naturally. Eating lychee can benefit those suffering from colds, fever and sore throats.

Lychee helps the body to digest food properly for the best nutrition and an added boost of health.

A study showed that litchi extract could trim the waist line. Human volunteers taking a daily supplement of the commercially available lychee extract Oligonol lost about three centimetres in their waist size, as well as a 6 per cent reduction in subcutaneous fat area and a 15 per cent reduction in abdominal (visceral) fat.

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8. SAPOTA (*Manilkara zapota* van Royen)

One of the most interesting and desirable of all tropical fruit trees, the sapodilla, a member of the family Sapotaceae, is now known botanically as *Manilkara zapota* van Royen (syns. *M. achras* Fosb., *M. zapotilla* Gilly; *Achras sapota* L., *A. zapota* L.; *Sapota achras* Mill.). The sapodilla is believed native to Yucatan and possibly other nearby parts of southern Mexico, as well as northern Belize and Northeastern Guatemala. But now its cultivation is extensive in coastal India (Morton, 1987).

USES

Sapota is used mostly for dessert purpose. Generally, the ripe sapodilla, unchilled or preferably chilled, is merely cut in half and the flesh is eaten with a spoon. It is an ideal dessert fruit as the skin, which is not eaten, remains firm enough to serve as a "shell". Care must be taken not to swallow a seed, as the protruding hook might cause lodging in the throat. The flesh, of course, may be scooped out and added to fruit cups or salads. A dessert sauce is made by peeling and seeding ripe sapodillas, pressing the flesh through a colander, adding orange juice, and topping with whipped cream. Sapodilla flesh may also be blended into an egg custard mix before baking.

The fruits are used for production of mixed jam , industrial glucose, pectin and jelly. It can be canned as slices or made in to sharbat and halwa. Chicle, used in the manufacture of chewing gums and in industry, is made from the latex which is obtained by tapping the trunk.

Nutritional Composition of Sapota (Chikoo)

Component	Quantity per 100 g	Component	Quantity per 100 g
Moisture	73.7 g	Calcium	28.0 mg/100g
Carbohydrates	21.4 g	Phosphorus	27.0/mg/100g
Sugars	12-18 g	Iron	2.0 mg/100g
Protein	0.7 g	Ascorbic acid	6.0 mg/100g
Fat	1.1 g		

(Bose and Mitra, 1990**)**

Phytochemicals

Activity-guided fractionation of a methanol extract from the fruit of Manilkara zapota cv. Tikal resulted in the isolation of two new antioxidants, methyl 4-O-galloylchlorogenate and 4-O-galloylchlorogenic acid , along with eight known

polyphenolic antioxidants, namely, methyl chlorogenate , dihydromyricetin , quercitrin myricitrin , (+)-catechin , (-)-epicatechin , (+)-gallocatechin , and gallic acid (Ma et al, 2003). Research has indicated that unripe Chikoo fruits (*Manilkara zapota* L.) are an excellent source of antioxidants, with over 3000 mg of L-ascorbic acid equivalent antioxidant capacity (AEAC) per 100 g of fresh sample. Shui et al (2004) isolated 24 antioxidants in an extract of chikoo and characterized through a free radical spiking test. Their chemical structures were proposed using high-performance liquid chromatography-mass spectrometry (HPLC-MS) and tandem MS (HPLC/MSn). The antioxidant capacity of Chikoo fruits was mainly attributed to polyphenolics with basic blocks of gallocatechin or catechin or both. The changes of total antioxidant capacity (TAC) and total phenolics content (TPC) of ciku king fruits with storage time were also investigated. It was found that the TAC and TPC decreased significantly as the fruits gradually changed from the unripe to the overripe stage. The best time for one to consume ciku king fruits at a flavorful stage with high amounts of antioxidants with AEAC values ranging from 600 to 1200 mg per 100 g fresh sample is suggested. The change of the content of major antioxidant peaks was also consistent with changes of antioxidant levels during storage.

Pharmacological Evidence

Natural antioxidants have a wide range of biochemical activities, including inhibition of ROS generation, direct or indirect scavenging of free radicals, and alteration of intra cellular redox potential. Antioxidants are naturally abundant in fruits and are able to neutralize free radicals donating an electron and converting them to harmless molecules (Leonard et al, 2002; Abdollahi et al, 2005).

In vitro studies of Ma et al (2003) indicated that Methyl 4-O-galloylchlorogenate and 4-O-galloylchlorogenic acid isolated for Litchi displayed high antioxidant activity in the DPPH free-radical assay and cytotoxicity in the HCT-116 and SW-480 human colon cancer cell lines.

Health Benefits and Curative Properties

(http://india4indians.com/health/2010/01/09/sapodilla-or-chikoo; http://www.hort.purdue.edu/newcrop/morton/sapodilla.html#Food Uses)

- Sapodilla is rich in dietary fiber (5.6 g/100g), which makes it a good bulk laxative. The fiber content helps relieve constipation episodes and also helps protect the mucous membrane of the colon from cancer causing toxins by firmly binding to them.

- The fruit is rich in antioxidant poly-phenolic compound **tannin**. Tannins have shown to have potential antiviral, antibacterial and anti-parasitic effects. Tannins have many useful applications medicinally as anti-diarrheal, hemostatic, and anti-hemorrhoidal remedies.

- It contains good amounts of antioxidant vitamins like **vitamin C** and vitamin A. Vitamin A is essential for vision. It is also required for maintaining healthy mucus membranes and skin. Consumption of natural fruits rich in vitamin A known to protect from lung and oral cavity cancers. So also, consumption of foods rich in vitamin C helps body develop resistance against infectious agents and scavenge harmful free radicals.

- Fresh ripen sapodilla are good source of minerals like potassium, copper, iron and vitamins like folate, niacin and pantothenic acid. These compounds are essential for optimal health as they involve in various metabolic processes in the body as cofactors for the enzymes

- Because of the tannin content, young fruits are boiled and the decoction taken to stop diarrhea.

- An infusion of the young fruits and the flowers is drunk to relieve pulmonary complaints.

- A decoction of old, yellowed leaves is drunk as a remedy for coughs, colds and diarrhea. A "tea" of the bark is regarded as a febrifuge and is said to halt diarrhea and dysentery.

- The crushed seeds have a diuretic action and are claimed to expel bladder and kidney stones.

- A fluid extract of the crushed seeds is employed in Yucatan as a sedative and soporific.

- A combined decoction of sapodilla and chayote leaves is sweetened and taken daily to lower blood pressure.

- A paste of the seeds is applied on stings and bites from venomous animals.

- The latex is used in the tropics as a crude filling for tooth cavities

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9. BER (*Zizypus. mauritiana* Lam.)

The Ber, Indian jujube, *Z. mauritiana* Lam. (syn. *Z. jujuba* L.) is adapted to warm climates. It belongs to the family Rhamnaceae. It is often called merely jujube, or Chinese date, which leads to confusion with the hardier species. Other English names are Indian Plum, Indian cherry and Malay jujube. In India, there are 90 or more cultivars differing in the habit of the tree, leaf shape, fruit form, size, color, flavor, keeping quality, and fruiting season (Morton, 1987).

Uses

Ber (Zizyphus) is egg-shaped fruit of orange or brown colour, with edible acid pulp and hard central stone. The Jujube is classed with the raisin, date, and fig as a pectoral fruit, being nutritive and demulcent. It is eaten both fresh and dried. Bark is used for tanning. Leaves are laxative and used in throat trouble. Leaves are also used as a good fooder particularly in arid zones. The tree serves as a host for lac insects. Wood is used for making agricultural implements and tool handles. The preserved products made of ber fruit are murabba., candy, diced ber , dehydrated ber , ber pulp ber jam etc.

Nutritional Composition (per 100 g edible portion)

Component	**Quantity**	**Component**	**Quantity**
Moisture	81 g/100 g	Ascorbic acid	65-150 mg/100 g
Carbohydrates	17.0 g/100 g	Carotene	21 Ug/100 g
Protein	0.8 g/100 g	Niacin	0.7 mg/100 g
Fat	0.3 g/100 g	Thiamine	0.02 mg/100 g
Calcium	4 mg/100 g	Riboflavin	0.05 mg/100 g

Phosphorus	9 mg/100 g	Energy	74 Kcal/100 g
Iron	1.8 mg/100g		

(Gopalan et al., 1985)

Phytochemicals

The fruit contains triterpenes betulinic acid, aiphitolic acid, betulonic acid, oleanonic acid, maslinic acid, oleanolic acid and ursolic acid together with a number of isomeric b-coumaric acid esters of aiphitolic and maslinic acid1'2. Two alkaloids named zizyphusine and daechucyclopeptide- 1 were also isolated from the fruit. Ziziphussaponin I, ziziphussaponin II, ziziphussaponin III (ziziphussaponin I,II,III), jujuboside B and stepharine, are the other phytochemicals found in Ber (Higuchi et al, 1984; Nawwar et al, 1984). It is interesting to note that the fruit yields relatively high amounts of cAMP and cGMP. Their contents in dry fruit were 100-500 nmol/g and 30-SO nmoL/g, respectively. From the seed of Z. jujuba, three saponins jujubosides A and B, and ziziphin were isolated. Furthermore, flavone C-glycosides swertisin and spinosin as well as the acylated derivatives of spinosin sinapoyl-, feruloyl- and coumaroylspinosin were also found in the seed. (Mahajan and Chopda, 2009; Singh et al, 2007;).

Pharmacological Evidence on mode of action of phytochemicals

(http://www.itmonline.org/arts/zizyphus.htm**;** http://www.mdidea.com/products/new/new03004.html)

Anti-aging effects: Experiments show that Da Zao (Ber) has an inhibitory effect on the activity of mono amineoxidase-B (MAO-B) in mice.

Anti-tumor effects: Administering to mice for 14 consecutive days, Da Zao can inhibit sarcoma-180 (S180) with a 61% inhibition rate.

Anti-inflammatory effects: Extracts of Da Zao leaves can significantly inhibit dimethylbenzene-induced auricular inflammation in mice, egg white-induced toe swelling, and cotton ball-induced granulation tissue proliferation in rats.

Astringent and Febrifuge: The leaves are astringent and febrifuge. They are said to promote the growth of hair. They are used to form a plaster in the treatment of strangury.

Anodyne, anticancer, pectoral, refrigerant, sedative, stomachic, styptic and tonic: The dried fruits are anodyne, anticancer, pectoral, refrigerant, sedative, stomachic, styptic and tonic.They are considered to purify the blood and aid digestion.They are used internally in the treatment of chronic fatigue, loss of appetite, diarrhea, anemia, irritability and hysteria. The fruit strengthens the liver and is used by Chinese Practitioners for hepatitis and cirrhosis.

Counteracting mutation: Experiments show that oral administration of Da Zao decoction can significantly inhibit cyclophosphamide-induced increase in sister chromatid exchange (SCE), indicating that Da Zap has an anti-mutation effect.

Counteracting allergic reaction: Da Zao solution can suppress the release of leukotrien D4 by basophilic white blood cells in human peripheral blood.

Counteracting leukemia: Experiments show that water-based extract of Da Zao has a significant suppressive effect on the proliferation and colony formation of human leukemia K562 cells.

Effects on the cardiovascular system: Da Zao has a protective effect on experimental cardiac ischemia in rats. It can significantly increase the subjects' tolerance for oxygen deprivation, counteract various experimental cardiac arrhythmia, suppress platelet aggregation and affect the subjects' hemodynamics and blood rheology, and enhance rats' humoral and cell-mediated immune functions.

Effects on the phagocytosis of peritoneal macrophage: In-vivo experiments show that Hong Zao (Da Zao) can increase the phagocytosis of mice's mononuclear-phagocyte system.

Nutritive qualities: The ancient claims about its extraordinary nutritive qualities may reflect two aspects of jujube: first, persons who were especially weak and unable to eat ordinarily might find the mild and sweet taste of jujube acceptable and at least get some calories (e.g., about 40, still very little) and a small amount of protein, especially valuable if jujube was added to a nutritional dish to make it more palatable; second, persons who did not have much fruit in their diet might have had a low vitamin C level, which could be corrected with a relatively small quantity of jujube fruit or its extract.

Muscular strength and Increases Stamina: Jujube is both a delicious fruit and an effective herbal remedy. It improves muscular strength and increases stamina. In Chinese medicine it is prescribed as a tonic to strengthen liver function. In one clinical trial in China 12 patients with liver complaints were given jujube, peanuts and brown sugar nightly. In four weeks their liver function had improved.

Antioxidants: Jujube Fruit has the highest level of Antioxidants.Considerable laboratory evidence from chemical, cell culture, and animal studies indicates that antioxidants may slow or possibly prevent the development of cancer.

Anti-inflammatory: Betulinic acid has been reported also to possess anti-inflammatory activity. The anti-inflammatory activity of betulinic acid is, at least in part, due to its capacity to inhibit enzymes involved in leukotriene biosynthesis, including 5-lipoxygenase (Somatsu, S. et al.,., Skin and Urology 21: 138, 1959 and Inoue, H., et al.,. Chem Pharm Bull. 2:897-901, 1986).

Treatment of Cancer: Betulinic acid is known to exert its anti-melanoma activity by causing apoptosis (programmed cell death). Apoptosis culminates in the fragmentation of the cellular DNA which can be detected by using monoclonal antibodies to the fragmented DNA (mono and polyoligonucleosomes). Apoptosis may be used as an indicator for specific cytotoxicity of the test compound. Apoptosis was investigated as a probable (or one of the probable) mechanisms of action of betulinic acid for killing leukemia cells (MOLT-4).

There are several patents that relates to an orally effective herbal extract-based composition having broad-spectrum anticancer activity, more specifically a method of treating, inhibiting and/or preventing malignant tumors of the colon, intestine, stomach, breast, melanoma, glioblastoma, lung, cervix, ovary, prostate, oral cavity, larynx, liver, pancreas, kidney, bladder, endothelial cells, leukemia and myeloma using a herbal extract of Zizyphus, rich in betulinic acid. An advantage of the extract is that the betulinic acid has low systemic toxicity. The extract inhibits Protein Kinase C activity of cancer cells and induces apoptosis.

Although originally thought to exhibit specific cytotoxicity against melanoma cells, this agent has been found to be cytotoxic against non-melanoma tumor cell types including neuro ectodermal and brain tumor cells.

Treatment of HIV: Betulinic acid and dihydrobetulinic acid acyl derivatives have been found to have potent anti-HIV activity (WO 96/39033). Anti-HIV assays indicated that 3-O-(3', 3'-diimethylsuccinyl)-betulinic acid and dihydrobetulinic acid both demonstrated extremely potent anti-HIV activity in acutely infected H9 lymphocytes with EC.sub.50 values of less than 1.7 times 10. sup.-5.mu.M, respectively.

Intercellular Communication: Inter-Cellular Communication within the human body relies on the two messenger molecules, cGMP and cAMP; responsible for pretty much EVERY SINGLE process that takes place in the body. the Jujube fruit has one the highest concentration of cGMP and cAMP of anything -- plant or animal -- known to man. A multitude of interesting health benefits result from better inter-cellular communication.

Other Medicine Uses: The jujube is a remedy for anemia, hypertonia, nephritis and nervous diseases.The fruit will impart energy without nervousness. Described as a calm energy.The plant is widely used in China as a treatment for burns.The fruits are used in Chinese traditional medicine, where they are believed to alleviate stress. The fruit is ground to powder, with very small amounts required to promptly calm nerves and purify blood quality.Ziziphin, a compound in the leaves of the jujube, suppresses the ability to perceive sweet taste in humans. The fruit, being mucilaginous, is also very soothing to the throat and decoctions of jujube have often been used in pharmacy to treat sore throats.

Health Benefits and Curative Properties (Dash and Padhy, 2006**)**

- The bark is useful in arresting secretion or bleeding. The fruit purifies the blood and aids digestion.

- Zizyphus is beneficial in the treatment of mental retardation. A handful of the dry fruit is boiled in half a litre of water till it is reduced to half. Sugar or honey can be added to taste and given daily at night before retiring. It increases the functioning of the brain by releasing more glutamic acid into the bloodstream.

- Zizyphus is useful in preventing frequent attack of colds and influenza. A teaspoon. Of the fresh juice of the fruit can be taken with a pinch of pepper once daily for preventing colds.

- The bark can be used for treatment diarrhoea and colic. The infusion of the inner covering of the bark is used as a purgative in constipation.

- Fresh baked leaves are useful in piles. The leaves are barked by placing them over the covered mouth of vessel with water boiling. The leaves are covered with another plate to prevent steam from escaping. Those baked leaves are pounded with some castor oil. This warm poultice can be applied over the piles. The process should be repeated twice daily for a week.

- Infusion of the fresh and tender leaves, mixed with salt is a useful gargle for sore throat, relaxed uvula, inflammation of the mouth, bleeding from gums and cracked tongue due to excessive consumption of sour fruits.

- A paste of the leaves and twigs can be applied with excellent result over boils, carbuncles and abcesses to promote suppuration. It can also be applied beneficially over painful boils and styes. This paste, mixed with a teaspoon of lime juice can be applied as a poultice in the treatment of scorpion sting. Infusion of its leaves can be applied as a lotion to wash the wounds and other ulcers.

- The leaves are valuable in treating conjunctivitis. An infusion of the leaves should be used as an eye lotion.

- The paste of its leaves applied over the scalp and hair can keep them clean and prevents scalp diseases. It also lenthens the hair besides darkening them.

(http://www.mdidea.com/products/new/new03003.html; http://www.ayurnepal.com/en/zizyphus-jujuba-.html)

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10. JACKFRUIT (*Artocarpus heterophyllus* Lam)

The jackfruit, *Artocarpus heterophyllus* Lam. of the family Moraceae, is also called jak-fruit, jak, jaca, and, in Malaysia and the Philippines, *nangka*; in Thailand, *khanun*; in Cambodia, *khnor*; in Laos, *mak mi* or *may mi*; in Vietnam, *mit*. No one knows the jackfruit's place of origin but it is believed indigenous to the rainforests of the Western Ghats. It is cultivated at low elevations throughout India, Burma, Ceylon, southern China, Malaya, and the East Indies. It is common in the Philippines, both cultivated and naturalized. It is grown to a limited extent in Queensland and Mauritius.

Uses

Both mature and immature fruits as well as seeds are used. Ripe fruit is used for dessert purpose and processing into various products while unripe bulbs are used for making chips. The immature fruit and seeds are used as vegetable. The bark is used for tanning purpose. Heart-wood yield a yellow dye. A yellow dye can also be extracted from the wood particles and used to dye cotton. The latex which flows from all parts of the plant when injured is also used as adhesive. The resins within the latex may also have some value in varnishes. The timber is a medium hardwood with desirable characteristics in making furniture, oars, implements and musical instruments and the wood is also used in construction. It is termite proof and fairly resistant to fungal and bacterial decay. The roots of older trees are good materials for carving and picture framing Leaves are utilized as a green fodder. Several processed products. Such as squash, nectar, fruit bar, toffies, jams, canned and dehydrated pulp, beverages, etc. .can be prepared from the pulp.Jackfruit honey, reduced to concentrate or powder, and used for preparing drinks. The seeds can be eaten boiled, roasted or dried and salted as table nuts, or they can be ground to make flour and blended with wheat flour for baking (International Centre for Underutilized crops, 2003).

Composition of Tender (per 100 g of edible portion)

Component	**Quantity (g/100 g)**	**Component**	**Quantity (mg/100g)**
Moisture	76.2	Calcium	20
Carbohydrates	19.8	Phosphorus	41
Protein	1.9	Iron	0.5
Fat	0.1	Potassium	303
Fibre	1.1	Thiamine	0.03

Minerals	0.9	Riboflavin	0.13
		Vitamin C	7.0

(Gopalan et al, 1985)

Phytochemicals

The J*ack fruit* contains various chemical constituents as several flavones colouring matters, morin, dihydromorin, cynomacurin, artocarpin , isoartocarpin, cyloartocarpin, artocarpesin, oxydihydroartocarpesin, artocarpetin, norartocarpetin, cycloartinone and artocarpanone (Rao et al, 1973). The plant also contains free suger (sucrose), fatty acids, ellagic acid and some essential Amino acids like Arginine, Cystine, Histidine, Leucine, Lysine, Metheonine, Theonine, Tryptophan etc. (Pavanasivam et al, 1973). Bark from main trunk contains betullic acid and two new flavone pigments, cycloheterophyllin ($C_{30}H_{30}O_7$) (Chawdhary, 1997). Triterpenic compounds like cycloartenyl acetate, cycloartenone are also reported (Barik et al, 1997). Heterophylol, a phenolic compound with novel skeleton was obtained from Artoca*ip*us *heterophyllus* (Lin et al, 1993) . The leaves and stem show the presence of sapogenins, cycloartenone, cycloartenol, β-sitosterol (Nath, 1937) and tannins, they show estrogenic activity. A root contains β-sitosterol, ursolic acid, Betulinic acid and cycloartenone (Dayal and Seshadri, 1974).

Three phenolic compounds were characterized as artocarpesin [(5, 7, 2', 4'-tetrahydroxy-6-β-methylbut-3-enyl) flavone], norartocarpetin (5, 7, 2',4'-tetrahydroxyflavone) and oxyresveratrol (trans- 2, 4, 3', 5'-tetrahydroxystilbene) by spectroscopic methods and through comparison with data reported in the literatures (Venkataraman, 2001). The anti-inflammatory effects of these isolated compounds were evaluated by determining their inhibitory effects on the production of proinflammatory mediators in lipopolysaccharide (LPS)-activated RAW 264.7 murine macrophage cells. These three compounds exhibited potent anti-inflammatory activity (Jha et al, 1997). The composition of carotenoids of *A.heterophyllus* is carotenes β-carotene, α - carotene, β-zeacarotene, α-zeacarotene and β-carotene-5, 6-epoxide and a dicarboxylic carotenoid, crocetin were identified (Chandrika et al, 2004).

Pharmcological Evidence for Medicinal Properties of Jack fruit.

Jack fruit plant extracts significantly lowered the fasting blood glucose level and markedly improved glucose tolerance in Sprague-Dawley rats. The hypoglycaemic

activity of *A. heterophyllus* or *B. vulgaris* was better than that of tolbutamide (Fernando et al, 1990). Ko et al (1998) reported that cycloheterophyllin and artonins A and B isolated from Jack fruit served as powerful antioxidants against lipid peroxidation when biomembranes are exposed to oxygen radicals.

The crude methanolic extracts of the stem and root barks, stem and root heart-wood, leaves, fruits and seeds of Artocarpus heterophyllus and their subsequent partitioning with petrol, dichloromethane, ethyl acetate and butanol gave fractions that exhibited a broad spectrum of antibacterial activity (Khan et al, 2003). Methanolic extracts obtained from 13 plants were studied for their antibacterial activity against cariogenic bacteria. Among them, the extract from *Artocarpus heterophyllus* showed the most intensive activity. Serial chromatographic purifications offered two active compounds which were identified as 6-(3-methyl-1-butenyl)-5,2',4'-trihydroxy-3-isoprenyl-7-methoxy flavone and 5,7,2',4'-tetrahydroxy-6-isoprenylflavone. Both isolates completely inhibited the growth of primary cariogenic bacteria at 3.13-12.5 micrograms/ ml. They also exhibited the growth inhibitory effects on plaque-forming streptococci. These phytochemical isoprenylflavones would be potent compounds for the prevention of dental caries (Sato et al, 1996). Results from the study conducted by Kotowaroo et al (2006) indicate that Artocarpus heterophyllus could act as a 'starch blocker' thereby reducing post-prandial glucose peaks and managing the diabetes.

Fang et al (2008) indicated that among the phenols isolated from Jack fruit, artocarpesin (1) suppressed the LPS-induced production of nitric oxide (NO) and prostaglandin E 2 (PGE 2) through the down-regulation of inducible nitric oxide synthase (iNOS) and cyclooxygenase 2 (COX-2) protein expressions. Hence, artocarpesin (1) may provide a potential therapeutic approach for inflammation-associated disorders.

In a screening for anticancer agents from natural resources, artocarpin [6-(3-methyl-1-butenyl)-5,2',4'-trihydroxy-3-isoprenyl-7-methoxyflavone] isolated from wood of jack fruit (*Artocarpus heterophyllus*) showed potent cytotoxic activity on human T47D breast cancer cells. The mode of action of artocarpin was evaluated by its effect on cell viability, nuclear morphology, cell cycle progression, expression of protein markers for apoptosis, and mitochondrial membrane potential (Delta psi m). These results showed that artocarpin caused a reduction of cell viability in a concentration-dependent manner and an alteration of cell and nuclear morphology (Arung et al,2010).

One hypothesis that has been advanced is that the protection against diseases, such as cancer and cardiovascular diseases, can be attributed to a large class of antioxidant phytochemicals, termed flavonoids, contained in fruits and vegetables .The phytochemicals, refer primarily to the flavonoids found in fruits, vegetables, nuts, seeds, stems, and flowers, as well as in tea and wine. Flavonoids are diphenylpropanes that commonly occur in plants; >4000 flavonoids have been identified. The common family members of flavonoids include flavones, isoflavones, flavanones, anthocyanins, flavans, and proanthocyanidins. Flavonoids have long been recognized to possess antiallergic,

antiinflammatory, antiviral, antiproliferative, and anticarcinogenic activities (Ronald and Guohua 2000; Middleton and Kandaswami 1993).

Health Benefits and Curative Properties

Different parts of the jackfruit tree have medicinal properties. The pulp and seeds are used as a tonic, the warmed leaves have healing properties if placed onto wounds, and the latex, mixed with vinegar promotes healing of abscesses, snakebite and glandular swellings. The wood has a sedative effect and its pith is said to cause abortion. Theroot is used as a remedy against skin diseases and asthma, and its extract is taken in cases of fever and diarrhea. Jackfruit is very functional when it comes to lowering blood pressure due to its very high level in potassium. The root of the Jackfruit is known to have many remedial benefits. Its extracts are used by medicine to cure fever and diarrhea, it is also found to be valuable for asthma patients, and used to treat many skin problems as well. Their health benefits are wide-ranging from anti-cancer to antihypertensive, anti-ageing, antioxidant, anti-ulcer. (http://www.fruitsinfo.com/Jack-Fruit-Exotic-fruits.php).

Health Benefits and Curative Properties

(http://www.online-family-doctor.com/fruits/jack-fruit.html)

The Chinese consider jackfruit pulp and seeds tonic, cooling and nutritious, and to be "useful in overcoming the influence of alcohol on the system."

- The seed starch is given to relieve biliousness and the roasted seeds are regarded as aphrodisiac.
- The ash of jackfruit leaves, burned with corn and coconut shells, is used alone or mixed with coconut oil to heal ulcers.
- The dried latex yields artostenone, convertible to artosterone, a compound with marked androgenic action.
- Mixed with vinegar, the latex promotes healing of abscesses, snakebite and glandular swellings.
- The root is a remedy for skin diseases and asthma. An extract of the root is taken in cases of fever and diarrhea.
- The bark is made into poultices. Heated leaves are placed on wounds.
- The wood has a sedative property; its pith is said to produce abortion.
- The burnt residue of jackfruit leaves mixed with burnt corn and coconut shells is used to heal ulcers.
- The roasted seeds are said to be an aphrodisiac.

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11. PINEAPPLE (*Ananas comosus* Merr.)

The pineapple is the leading edible member of the family Bromeliaceae which embraces about 2,000 species, mostly epiphytic and many strikingly ornamental. Now known botanically as *Ananas comosus* Merr. (syns. *A. sativus* Schult. f., *Ananassa sativa* Lindl., *Bromelia ananas* L., *B. comosa* L.), the fruit has acquired few vernacular names. It is widely called *pina* by Spanish-speaking people, *abacaxi* in the Portuguese tongue, *ananas* by the Dutch and French and the people of former French and Dutch colonies; *nanas* in southern Asia and the East Indes. In China, it is *po-lo-mah;* sometimes in Jamaica, sweet pine; in Guatemala often merely "pine

Uses

Field ripe fruits are best for eating fresh. Pineapple is consumed both in fresh and processed form. Pineapple fruits are processed in various ways. The main products are slices in cans, juice, chunks, dice, fruits salad, sugar syrup, alcohol and citric acid. Fruit core is used for preparing candy. Dried wastes after juice extraction can be used as a cattle feed (Morton, 1987).

Nutritional Composition of pineapple (per 100 g of edible portion)

Component	Quantity per 100 g	Component	Quantity per 100 g

Water	80-85 g	Calcium	0.02 mg/100 g
Sugar	12-15 g	Phosphorus	0.01 mg/100 g
Acid	0.6 g	Iron	0.9 mg/100 g
Protein	0.4 g	Carotene	60 IU
Ash	0.3-0.42 g	Riboflavin	120 mg/100 g
Fat	0.1 g	Ascorbic acid	40 mg/100 g
Fibre	0.3 g		

(Bose and Mitra,1990)

Chemical Composition of Pineapple

Ripe & Raw Pineapple	Per 100g	*Vitamins*	Per 100g
Water	86 g	Ascorbic Acid (Vitamin C)	15 mg
Energy	49 kcal	Vitamin B-12	0 mcg
Energy	205 kj	Vitamin B-6	0.09 mg
Protein	0.50 g	Vitamin A, IU	50 IU
Total dietary fiber	1.2 g	Vitamin A, RE/p>	3 mcg_RE
Lipid Fat	0.20 g	Vitamin E	1.0 mg_ATE
Ash	0.29 g	Vitamin K	0.7 mcg
Calcium	7 mg	Folate (total)	11 mcg
Phosphorus	7 mg	Folate, food	11 mcg
Iron	0.37 mg	Folate, DFE	11 mcg_DFE
Sodium	1 mg	Thiamin	0.09 ug
Potassium	113 mg	Riboflavin	0.036 mg
Magnesium	14 mg	Niacin	0.42 mg
Copper	0.11 mg	Pantothenic acid	0.16 mg
Manganese	1.65 mg	Tocopherol, alpha	0.10 mg
Selenium	0.6 mcg		
Glucose (Dextrose)	1.7 g	Beta Carotene	31 mcg
Fructose	1.9 g	Alpha Carotene	0 mcg
Total sugars	8 g	Cryptoxanthin, beta	0 mcg

Phytochemicals

Pineapple contains a proteolytic enzyme bromelain, which digests food by breaking down protein. Only modest quantites of blomelain are in the edible parts of the fruit, all commercially available bromelain is derived from the stem. Bromelain supplements are particularly popular among athletes for treating all sorts of physical aches and injuries. There are questions about how well bromelain is absorbed, and to many herbal authorities the value may be overstated. Nature gave us many similar

proteolytic enzymes, that are more highly concentrated in the edible parts of the plants. Pineapple is healthy fruit, a good source of manganese, as well as containing significant amounts of Vitamin C.

Pharmacological Evidence

Recently, it has emerged that extracellular proteases have specific regulatory roles in modulating immune responses. Proteases may act as signaling molecules to activate the Raf-1/extracellular regulated kinase (ERK)-2 pathway to participate in mitogenesis, apoptosis, and cytokine production. Most reports on the role of protease-mediated cell signaling, however, focus on their stimulatory effects. show for the first time that extracellular proteases may also block signal transduction. Tracey et al (1997) showed that bromelain, a mixture of cysteine proteases from pineapple stems, blocks activation of ERK-2 in Th0 cells stimulated via the TCR with anti-CD3e mAb, or stimulated with combined PMA and calcium ionophore. They reported that inhibitory activity of bromelain was dependent on its proteolytic activity, as ERK-2 inhibition was abrogated by E-64, a selective cysteine protease inhibitor. However, inhibitory effects were not caused by nonspecific proteolysis, as the protease trypsin had no effect on ERK activation. Bromelain also inhibited PMA-induced IL-2, IFN-g, and IL-4 mRNA accumulation, but had no effect on TCR-induced cytokine mRNA production. The results indicate that bromelain is a novel inhibitor of T cell signal transduction and suggests a novel role for extracellular proteases as inhibitors of intracellular signal transduction pathways.

Bromelain, the proteolytic enzyme in pineapple can effectively improve the digestion of proteins and other foods. It assists the body by enhancing the assimilation of herbs, vitamins and other nutrients. Bromelain "releases" inflammation by breaking down proteins in swollen tissues. It also helps the digestion of proteins, stops blood clot formation, and has antiviral properties. Bromelain inhibits the formation of prostaglandin E2 (PGE2), a chemical in the body that causes inflammation. At the same time, it stimulates the production of prostaglandin E: (PGEj), an anti-inflammatory chemical. Research demonstrates bromelain helps the body eliminate substances related to arthritis and triggers the release of a prostaglandin that tamps down inflammation (Tracey et al, 1999). It has been indicated that bromelain is a novel inhibitor of T cell signal transduction and suggests a novel role for extracellular proteases as inhibitors of intracellular signal transduction pathways (Tan et al, 2002).

Pineapple is reported to have melatonin which is a proven potent free-radical scavenger and a broad spectrum antioxidant in animals (Chapman, et al, 1997).This led researchers to deduce that the indole presumably acted in a similar manner in plants. The discovery that bromelain inhibits signaling by ERK-2 and p21*ras* may account for its antiinflammatory and antitumor action. Many reports about the role of proteases in disease have centered around their potential to cause damage(Tracey et al, 1997; Cooreman et al, 1976).

Health Benefits and Curative Properties

Bromelain is considered to have a range of beneficial properties (Maurer, 2001; Taussig and Batkin, 1988; Pirotta and Morghen, 1978), such as anti-inflammatory and analgesic actions, and anti-oedematous, antithrombotic and fibrinolytic effects (Taussig and Batkin, 1988). Its antiinflammatory effects are thought to be mediated by: (i) increasing serum fibrinolytic activity (Livio et al, 1978) thus reducing plasma fibrinogen levels10 and decreasing bradykinin levels (which results in reduced vascular permeability), and hence reducing oedema and relieving pain (Bodi, 1966) and (ii) mediating prostaglandin levels (by decreasing levels of PGE2 and thromboxane A2). Analgesic properties have been demonstrated in a variety of models,(Lotti et al, 1993; Uhlig and Die, 1981) and are thought to be a result of a direct influence on pain mediators (e.g. bradykinin11), as well as indirect effects through anti-inflammatory actions (e.g. reduction in oedema, debris and immune complexes).

The pineapple fruit has vitamins, minerals, fiber and enzymes that is good for the digestive system and helps in maintaining ideal weight and balanced nutrition. Pineapples are a good source of Vitamin C and can be eaten raw or used in cooking. Pineapple has minimal fat and sodium with no-cholesterol(http://www.home-remedies-treatment.com/blog/the-goodness-of-pineapple/) . Bromelain present in pineapple can be used to cure sinusitis, headaches and brochial disorders. It can also heal wounds effectively. It can be used to combat against arthritis and heart diseases. Swelling caused by muscle sprains are also effectively eliminated by this anti-inflammatory agent. Pineapple also aids digestion particularly after a heavy non-vegetarian meal. It may also be used to suppress the appetite and has been known to heal gastric ulcers effectively. The juice is often mixed with cosmetic products and helps in keeping the skin soft and supple. Extracts of Bromelain can be used successfully in removing warts. The natives of Guadeloupe use this enzyme as a hair removing agent.

(http://www.blackriverweyr.com/index.php?title=Pineapple#Medicinal).

Pineapple juice is taken as a diuretic and to expedite labor, also as a gargle in cases of sore throat and as an antidote for seasickness. The flesh of very young (toxic) fruits is deliberately ingested to achieve abortion (a little with honey on 3 successive mornings); also to expel intestinal worms; and as a drastic treatment for venereal diseases. The dried, powdered root is a remedy for edema. The crushed rind is applied on fractures and the rind decoction with rosemary is applied on hemorrhoids. The leaf juice as a purgative, emmenagogue and vermifuge.

Since it is extremely rich in vitamin C, pineapple has positive effects on protecting the body from free radicals that cause atherosclerosis, bronchitis, heart diseases associated with diabetes, asthmatic attacks, osteoarthritis and rheumatoid

arthritis, and damage bowel cells which may lead to cancer. Diets high in vitamin C has a beneficial effect on the proper functioning of the immune system (Tracey et al, 1999).

Pineapple contains micro-nutrients that experts believe protects against cancer and this micro-nutrients also break up blood clots and is beneficial to the heart. The ripe pineapple has diuretic properties. Pineapple juices also kills intestinal worms. It also relieves intestinal disorders and soothes the bile. Pineapple juice contains chemicals that stimulates the kidneys and aids in removing toxic elements in the body.

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12. PAPAYA (*Carica papaya* Linn.)

The papaya (Carica papaya L.) belongs to the family Caricaceae. It is an important fruit of tropical and subtropical regions of the world. It is native to tropical America and was introduced in India in 16th Century.

Uses

Ripe fresh fruits are eaten throughout the tropics. They are used in preparation of jam, soft drinks, ice cream flavouring, crystallized fruits and are canned in syrup. The seeds are also used for their medicinal value. Unripe fruits are commonly used as vegetable for cooking. Immature fruit contains the enzyme papain which has several uses. From green fruits, papain, pectin and tuty fruity can be prepared. With ripe fruits a number of products like papaya chunks in syrup, paree, concentrate, nectar, beverage base, fruit bar, osmo-air dried papaya for candy preparation, papaya cereal flakes are prepared. Papain, prepared from the dried latex of immature fruits, is a proteolytic enzyme similar in action to pepsin and is used in meat tenderizing. Papay is also used in manufacture of chewing gum and cosmetics and as drug for digestive ailments.

Nutritional Composition of ripe fruits (per 100 g of edible portion)

Component	**Quantity**	**Component**	**Quantity (**mg/100 g**)**
Moisture	89.60 g/100 g	Thiamin	0.04 mg/100 g
Carbohydrates	9.50 g/100 g	Ascorbic acid	65.50 mg/100 g
Protein	0.50 g/100 g	Nicotinic acid	0.20 mg/100 g
Fat	0.10 g/100 g	Riboflavin	250.00 mg/100 g
Calcium	0.01 mg/100 g	Vitamin A	2020 IU/100 g
Phosphorus	0.01 mg/100 g		
Iron	0.40 mg/100 g		

(Bose and Mitra,1990)

Phytochemicals

Good amount of vitamin C is found in papaya. Researchers are currently studying vitamin C as an alternative cancer treatment. It is a powerful antioxidant and must be obtained from food because the human body cannot create its own vitamin C. Vitamin E is another well known antioxidant found in the papaya, well known for skin health and as a blood thinner.

Beta-carotene, which the body converts to vitamin A, is another nutrient provided by the papaya. The compounds that give fruits and vegetables their different colors nourish the human body. Beta_-Carotene, alpha-carotene, and beta-cryptoxanthin are able to function as provitamin A. Zeaxanthin and lutein are the major carotenoids in the

macular region (yellow spot) of the retina in humans.Orange vegetables and fruits, including carrots,According to papaya nutrient details provided by Nutrition Data, one serving of papaya provides over 30% of the recommended daily allowance for vitamin A.

A compound known as papain is derived from the papaya fruit and has long been used as a natural meat tenderizer. It is believed that this enzyme may help the body digest meats and amino acids more efficiently. The papaya is an amazingly rich source of the proteolytic enzymes.

It is said that phytochemicals in the papaya suppress the effects of progesterone because of which it has contraceptive properties. Carpaine alkaloid occurring in green parts and in seeds, is reported to have been used as a heartstimulant, as diuretic and for treatment of amoebic dysentery.

Papaya pills, juices, and whole food supplements containing papaya are being promoted as weight loss aids, digestive aids, and natural pain relievers, as well as for other health benefits. Like many fruits, it is fat-free, cholesterol free, very low in sodium and high in the vitamins C, A, E, K and folate.[2,3,4]. It is a rich source of anti-oxidant nutrients such as beta-carotene and flavonoids, B vitamins, folate and pantothenic acid. It also contains small amounts of of the minerals calcium, chlorine, iron, phosphorus, potassium, silicon and sodium.

Papaya contains arginine which is known to be essential for male fertility and also carpain, an enzyme thought to be good for the heart. Fibrin also occurs and this substance is not commonly found in the plant kingdom; in man it forms part of the blood clotting process.

Pharmacology

Papaya has several antioxidants like beta-carotene, vitamin C, flavanoids and others. Nonenzymatic components of the antioxidant defense system interrupt the free radical–initiated chain reaction of oxidation or scavenge and disable free radicals before they react with cellular components. The antioxidant capacity of constituents of vegetables and fruit has been documented in several human intervention studies, although most of the work has been directed toward effects detectable in blood samples. Typically, the antioxidant vitamins C and E and beta-carotene have received the most attention (Allard et al, 1994; Brown et al, 1994; Vasankari et al, 1997). Ten weeks of 280 mg *all-rac*-a-tocopherol acetate daily, compared with placebo, reduced erythrocyte susceptibility to hydrogen peroxide–induced lipid peroxidation and lowered plasma concentrations of lipid peroxides, thiobarbituric acid–reactive substances (TBARS), and conjugated dienes in both smokers and nonsmokers (Evans et al, 1996). A randomized, double-blind controlled trial with either 20 mg b-carotene or placebo daily for 4 wk showed a significant reduction in breath pentane output and a trend toward lower breath ethane output with the beta-carotene supplement in smokers; this effect was not observed in nonsmokers (Allard et al, 1994). (Breath pentane and ethane are end products of the

peroxidation of n–6 and n–3 fatty acids, respectively, and are useful, noninvasive measures of lipid peroxidation.).

One study tested the effect of 4-wk of supplements of vegetable and fruit extracts, including sources of flavonoids, on lipid peroxide concentrations (Wise et al, 1996). The supplement included dried vegetable juice extracts from carrots, parsley, beets, broccoli, kale, cabbage, spinach, and tomatoes and fruit juice extracts from apples, oranges, pineapples, papayas, cranberries, and peaches. Plasma lipid peroxide concentrations in the 15 subjects decreased from 16.85 to 3.13 mmol/L within 1 wk and remained in this range through the additional 3 wk of treatment.

Folic acid found in papayas converts a substance called homocysteine into benign amino acids. When it remains unconverted, homocysteine can directly damage blood vessel walls and when level get too high, can cause a stroke or even a heart attack (http://www.healthnfitnesscare.com/health-benefits-of-papayas.html).

Because of its high antioxidant content, papaya can prevent cholesterol oxidation and can be use in a preventative treatments against atherosclerosis, strokes, heart attacks and diabetic heart disease.

Health Benefits and Curative Properties

The health benefits of papayas are too many to mention, but here is a list of cures for some of the more common ailments:

Anti-Inflammatory: The anti-inflammatory virtue from the papain in papaya greatly reduce inflammation in diseases such as rheumatoid arthritis, osteoarthritis, gout and asthma.

Prevention Of Colon Cancer,: The rich fiber in papaya bind to cancer-causing toxins in the colon and is eliminated from the body during bowel movements.

Digestive Aid: Papaya is commonly known for its fine and natural laxative virtue which aids digestion. Taken regularly, it can help habitual constipation, bleeding piles and chronic diarrhea.

Protection Against Emphysema,: If you are a smoker, or are frequently exposed to secondhand smoke, consume papaya juice regularly for its high vitamin A content. This may save your life as it will highly reduce your lung inflammation.

Protection Against Heart Disease,: The three very powerful anti-oxidants in papayas help prevent the oxidation of cholesterol. Oxidized cholesterol forms dangerous plagues that can eventually cause heart attacks or strokes.

Intestinal Disorders: The papain in unripe papaya is extremely beneficial for those who are deficient in gastric juice, have excess of unhealthy mucus in the stomach, dyspepsia and intestinal irritation.

Menstrual Irregularities: Consumption of unripe papaya juice help to contract the muscle fibers of the womb, resulting in proper and regular menstrual flow. It is especially helpful in cases of menstruation cessation in young ladies due to cold or trauma.

Skin Diseases: The juice from unripe papaya is highly beneficial in treating skin disorders like acne and psoriasis. When applied to wounds, it prevents pus formation and swelling. Paste made from unripe papaya when applied to the face, may remove pigmentation or brown spots, and making the skin smooth and delicate. Try it.

Spleen Enlargement: Immerse cut ripe papaya in vinegar for a week, then consume twice a day with meals until spleen is normalized.

Throat Disorders: Drink honey mixed in fresh juice from unripe papaya regularly over inflamed tonsils for diphtheria and other throat disorders. It dissolves the membrane and prevents infection from spreading.

Other Benefits

- Latex, the milklike juice from unripe papaya contains the most concentration of papain, some people say it can help remove freckles.
- The Papain's protein in papaya makes it helpful against heartburn and indigestion. Mixed with a little honey and taken before meals, it may even prevent heartburn.
- **Papain** also help thin the blood and discourage clotting.
- The fruit's **proteolytic enzymes** and other compounds, including a substance called carpaine, work against intestinal worms and other parasites.
- The whole papaya fruit is an excellent source of **dietary fiber,** which is also necessary for digestive health. Papaya pills are promoted for use as natural antacids, for ulcer relief and to relieve constipation.
- Unripe papaya has been used for contraceptive purposes by traditional healers in Pakistan, India and Sri Lanka. Scientific studies have confirmed that the fruit does have contraceptive effects on animals. It appears that phytochemicals in the papaya suppress the effects of progesterone.
- After treatment with antibiotics the use of papaya juice will quickly assist the restoration of the normal bacteria in the gut which will have been destroyed by the treatment.

- The skin of the papaya is a first class external treatment for skin wounds and places that do not heal quickly. The pulp from the juicer can be used for this and as a poultice.

http://EzineArticles.com/?expert=Russell_Cantwell
http://ezinearticles.com/?Amazing-Papaya-Medicinal-and-Nutritional-Values-From-Miracle-Fruit&id=497335

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13. GUAVA (*Psidium guajava*, Linn)

Guava (Psidium guajava, L.) belongs to the family Myrtaceae. It originated in tropical America and seems to have been grown from Mexico to Peru. It was introduced to India in early 17th Century. Besides India, it also grown in Sri Lanka, Hawaiian Islandsm and Cuba. In India the maximum area is in Uttar Pradesh.

Uses

Guava fruit is relished when mature or ripe and freshly plucked from the tree. Excellent salad and pudding are prepared from the shell of the ripe fruit. Ripe guave fruits emit a characteristic sweet aroma and has a pleasant sour-sweet taste. Ripe and unripe juicy fruits are eaten fresh. The fruits after removal of seeds, are used for preparing jam, jelly, paste, juice and nectar. It is also canned in sugars syrup and made into fruit butter. In some countries, the leaves are used for treating diarrhea and also for dyeing and tanning.

Nutritional Composition of guava (per 100 g of edible portion)

Component	Quantity (%)	Component	Quantity (mg/100g)
Water	81.7	Iron	1.4
Carbohydrates	11.2	Thiamine	0.03
Protein	0.9	Riboflavin	0.03
Fat	0.3	Niacin	0.40
Minerals	0.7	Vitamin C	212
Fibre	5.2		
Calcium	10 mg		
Phosphorus	28 mg		

(Gopalan et al, 1985)

Phyto chemicals

Guava is a rich source of ascorbic acid, pectin, fibre and iron. Pink guavas are one of the most common sources of lycopene besides tomatoes.; Lycopenes have the same effect of that of beta-carotene. Lycopene and beta-carotene are examples of acyclized and cyclized carotenoids, respectively. Carotenoid compounds most commonly occur in

nature in the all-*trans*form. The most characteristic feature of carotenoids is the long series of conjugated double bonds forming the central part of the molecule. This gives them their shape, chemical reactivity, and light-absorbing properties. beta-Carotene, alpha-carotene, and beta-cryptoxanthin are able to function as provitamin A. Zeaxanthin and lutein are the major carotenoids in the macular region (yellow spot) of the retina in humans. (Riua, 2004). Guava is also a rich source of ascorbic acid and dietary fibre besides iron and phosphorus. It has very high quality pectic substances also.

The extracts of guava leaf is reported to have several phytochemicals like tannins/ phenols. Quercetin is one of the principal ingredients found in guava.(Joseph & Priya,2011). Other phenolics found in guava are **amritoside (a glycoside -gentiobioside -of ellagic acid), guiajaverin and other triterpenoids. (**http://www.icnhs-herbal-medicine.page.tl/ Phytochemical-Content-of-Guava.htm).

Pharmacology and Nutritional benefits

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Isolated dietary fibers from vegetable and fruit sources, particularly pectins, have been shown to have hypocholesterolemic action in humans (Jenkins et al,1979; Cerda et al, 1988). The addition of pectin- and fiber-containing foods to experimental diets also lowers plasma cholesterol to varying degrees as follows: a variety of vegetables (570 g/d) and fresh apples (600 g/d) by 4% (Stasse- Wolthuis et al, 1980), fresh carrots (200 g/d) by 11% (Robertson et al, 1979), apples (350–400 g/d) by 8–11% (Sable Amplis et al, 1983), guava fruit (0.5–1 kg/d) by 8% (**[10]**). Addition of guava, a potassium-rich fruit, to the diet of patients with essential hypertension, was associated with net decreases in mean systolic and diastolic pressures of 7.5 and 8.5 mm Hg, respectively (Singh et al, 1993).

Cells in humans and other organisms are constantly exposed to a variety of oxidizing agents, some of which are necessary for life. These agents may be present in air, food, and water, or they may be produced by metabolic activity within cells. The key factor is to maintain a balance between oxidants and antioxidants to sustain optimal physiological conditions. Overproduction of oxidants can cause an imbalance, leading to oxidative stress, especially in chronic bacterial, viral, and parasitic infections (liu and Hotchkiss, 1995). Oxidative stress can cause oxidative damage to large biomolecules such as lipids, proteins, and DNA, resulting in an increased risk for cancer and CVD (Liu et l, 1995; Ames and Gold, 1991; Ames et al, 1993). To prevent or slow the oxidative stress induced by free radicals, sufficient amounts of antioxidants need to be consumed. Fruits, vegetables, and whole grains contain a wide variety of antioxidant compounds (phytochemicals), such as phenolics and carotenoids, and may help protect cellular systems from oxidative damage and also may lower the risk of
chronic diseases (Wang & Prior, 1996; Vinson et al, 2001; Adom et al, 2003).

Recently, a few derivatives of ascorbic acid were tested on cancer cells, among them ascorbic acid esters showed promising anticancer activity compared to ascorbic acid. Ascorbyl stearate was found to inhibit proliferation of human cancer cells by interfering with cell cycle progression, induced apoptosis by modulation of signal transduction pathways (Naidu, 2007).

Regarding physiological function of Ascorbic acid it is stated that it accelerates hydroxylation reactions by maintaining the active center of metal ions in a reduced state for optimal activity of enzymes hydroxylase and oxygenase. Ascorbic acid plays an important role in the maintenance of collagen which represents about one third of the total body protein. It constitutes the principal protein of skin, bones, teeth, cartilage, tendons, blood vessels, heart valves, inter vertebral discs, cornea and eye lens. Ascorbic acid is essential to maintain the enzyme prolyl and lysyl hydroxylase in an active form. The hydroxylation of proline and lysine is carried out by the enzyme prolyl hydroxylase using ascorbic acid as co-factor. Ascorbic acid deficiency results in reduced hydroxylation of proline and lysine, thus affecting collagen synthesis(Naidu, 2007).

Ascorbic acid plays a critical role in wound repair and healing/regeneration process as it stimulates collagen synthesis. Lipid peroxidation and oxidative modification of low density lipoproteins (LDL) are implicated in development of atherosclerosis (Steinbrecher et al, 1990). Vitamin C protects against oxidation of isolated LDL by different types of oxidative stress, including metal ion dependent and independent processes (Frei, 1997). Addition of iron to plasma devoid of ascorbic acid resulted in lipid peroxidation, whereas endogenous and exogenous ascorbic acid was found to inhibit the lipid oxidation in iron-over loaded human plasma (Berger et al, 1992). Similarly, when ascorbic acid was added to human serum supplemented with Cu2+, antioxidant activity rather than pro-oxidant effects were observed (Dasgupta and Zdunek, 1992).

Extensive animal, clinical and epidemiological studies were carried out on the role of ascorbic acid in the prevention of different types of cancers. A mixture of ascorbic acid and cupric sulfate significantly inhibited human mammary tumor growth in mice, while administered orally (Tsao, 1991). Ascorbic acid decreased the incidence of kidney tumors by estradiol or diethylstilbesterol in hamsters due to decrease in the formation of genotoxic metabolites viz., diethylstilbesterol-4'-4"-qunione (Liehr, 1991). Ascorbic acid and its derivatives were shown to be cytotoxic and inhibited the growth of a number of malignant and non-malignant cell lines *in vitro* and *in vivo* (Park and Kimler, 1991; Eckert et al, 1991; Murakami et al, 1992; Roomi et al, 1998).

Dehydroascorbic acid, the oxidized form of ascorbic acid was shown to cross the blood brain barrier by means of facilitative transport and was suggested to offer neuroprotection against cerebral ischemia by augmenting antioxidant levels of brain (Huang et al, 2001).

However there are controversial reports also on role of ascorbic acid in cancer development (Naidu, 2007).

Health Benefits and Curative Properties

- **Diarrhea & Dysentery:** Guava is very rich in astringents (compounds those make your gums feel tighter and fresh after you chew guava leaves or eat a raw guava or use some toothpaste) which binds up loose bowels in diarrhea. These astringents are alkaline in nature and have disinfectant and anti-bacterial properties, thus help cure dysentery by inhibiting microbial growth and removing extra mucus from the intestines. Further, other nutrients in guava, such as vitamin-C, Carotenoids and potassium strengthens and tones up the digestive system and disinfect it. Guava is also beneficial in gastroenteritis due to reasons stated above.

- **Constipation:** Guava is one of the riches sources of dietary fiber. Its seeds, if ingested whole or chewed, serve as excellent laxatives. These two properties of guava help forming bowels, retaining water and clean your intestines and excretory system thoroughly. It is said that single constipation can lead to seventy two types of ailments. It is absolutely true. Every way to your total health goes through proper digestion and more importantly, proper excretion. Guava ensures both of these.

- **Cough & Cold:** Juice of raw and immature guavas or decoction of guava-leaves is very helpful in giving relief in cough and cold by loosening cough, reducing mucus, disinfecting the respiratory tract, throat and lungs and inhibiting microbial activity due to its astringent properties. Guava is one of richest in vitamin-C and iron which are proven to be preventive against cold and viral infections. In some areas in India, roasted ripe guava is used as a remedy against extreme cases of cough and cold and congestion.

- **Skin Care:** Guavas can help improve your skin texture and avoid skin problems more than the best of beauty creams or skin toner gels can do. This is chiefly due to the abundance of astringents in its fruits (more in immature ones) and in leaves. You can benefit from it either by eating the fruits (this help tighten your muscles apart from your skin) or by washing your skin with the decoction of its immature fruits and leaves. It will tone up and tighten the loosened skin. In addition to the astringents, guava is very-very rich in vitamin-A, B, C and potassium which are very good anti oxidants and detoxifiers and keep your skin glowing and free from aging, wrinkles and other disorders.

- **High Blood Pressure:** Guava helps reduce cholesterol in blood and prevents it from thickening, thereby maintaining fluidity of blood and reducing blood pressure. Studies have shown that food stuffs which lack fiber (such a refined

flour) add to blood pressure, due to quick conversion to sugar. Guava, being very rich in fiber and hypoglycemic in nature, helps reduce blood pressure.

- **Weight Loss:** Guava is very helpful for those who want to lose weight without compromising with their intake of proteins, vitamins and fiber. Guava, being very high in roughage and very rich in vitamins, proteins and minerals, but with no cholesterol and less digestible carbohydrates, is very filling and satisfies appetite very easily. Just have a medium sized guava in the lunch and you will not feel hungry till night. But ironically, it helps gaining weight in lean and thin people. This is probably due to its richness in nutrients, which keeps your metabolism right helping proper absorption of nutrients.

- **Scurvy:** Guava can outdo many other fruits, including orange and other citrus fruits, when it comes to concentration of vitamin-C, whose deficiency causes scurvy and which is the only remedy to it. It contains five times the vitamin-C in oranges.

Other Benefits

1. Guava leaves and bark are used traditionally as a disinfectant and antiseptic for dressing wounds and sores

2. A decoction of Guava leaves is used for relieving tooth-ache and gum boils when used for gargling

3. The flowers of Guava are used for treating bronchitis

4. The Guava fresh leaf extract (decoction) is used to treat digestive disorders like diarrhoea and vomiting

5. Application of powdered leaves is believed to have soothing effect in rheumatic pains.

6. The fruit helps reduce high blood pressure.

7. It is also considered to increase the good cholesterol.

8. The guava leaf extract is also effective in treating gastrointestinal due to the presence of quercetin and other flavonoids.

9. The bark extract protects the heart and improve its functionality.

10. It is also used to treat acne and painful menses.

11. Guava bark is used medically as an astringent and to treat diarrhea in children,

12. The flowers are used to treat bronchitis, eye sores and to cool the body.

13. The fruit is also used as a tonic and laxative, and for the treatment of bleeding gums.

14. It is used to prevent and treat scurvy.

15. Use of the plant in treating malaria also finds mention in few reports.

16. Guava leaf tea is commonly used as a medicine against gastroenteritis (dysentry) and child diarrhea.

(http://www.organicfacts.net/health-benefits/fruit/health-benefits-of-guava.html)

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14. DATES (*Phoenix dactylifera* Linn.)

Date-palm belongs to Palmae family and is a prominent tree of the desert oases. Date palm is believed to be indigenous to countries around Persian Gulf. In India, it has been believed to be introduced by soldiers of Alexande the Great in 4th century B.C. It is nutrious fruit rich in sugar, iron, potassium, calcium and nitotinic acid. It also has small amounts of protein, copper, magnesium, chlorine, sulphur,vitamin A, B1, B2 are also present in date pulp.

Uses

Date palms produce many products that are useful to humans. The primary product is the date fruit, which can be eaten fresh, dried, or in various processed forms. In North Africa and the Middle East, some dates are harvested and consumed during the Khalal stage, when the fruit are still very astringent with a high tannin content (Dowson and Aten, 1962 ; Glasner et al. 2002; Kader,1992). Dates can be used in cereal, pudding, bread, pressed cakes, cookies, candy bars, ice cream, and date shakes (a California specialty). Date fruit also can be made into juice, vinegar, wine, beer, sugar, syrup, honey, chutney, pickle, paste, dip, and food flavoring (Barreveld, 1993; Glasner et al. 2002**)**.

It is said that thereare as many uses of dates as there are days in a year. The trunk and wood of date palms can be used as timber, wood, or fuel. Fiber from the trunk and leaves can be made into bags, baskets, camel saddles, cords, crates, fans, food covers, furniture, mats, paper, ropes, trays, and twine. Dried bundles of leaves (‘‘Barusti’’) can be made into shades, roofs, separating walls, and enclosures. Ribs of the leaves can be used to build boats (small fishing boats called ‘‘Shasha’’) or fishing traps. The base of the leaves and fruit stalks can be used for fuel. The pith of the palms can be made into date palm flour. Terminal buds (palm heart) can be eaten as a salad or as a cooked vegetable. Date seeds can be used as feed for livestock or strung as beads for decoration. Oil from date seeds can be manufactured into soap. (Chao and Krueger, 2007). Dates are considered a balanced and healthy diet and have several medicinal uses. Different products may be prepared from dates, such as vinegar, liquid sugar, juice and paste. Leaves are source of fibre used for making ropes baskets and cordage. Walking sticks are made from leafstalk.

Nutritional Composition of date (per 100 g of edible portion)

Component	Quantity (%)	Component	Quantity
Moisture	13.80	Iron	2.70 mg /100 g
Carbohydrates	73.00	Magnesium	20 mg/100 g
Protein	3.00	Potassium	521 mg/100 g
Fat	2.90	Selenium	0.34 mg/100 g
Fibre	5.20	Vitamin A	0.04 mg/100 g
Minerals	2.13	Vitamin B1	0.08 mg/100 g
Calcium	65 mg/ 100 g	Vitamin B2	0.05 mg/100g
Phosphorus	72 mg /100 g	Nicotinic acid	2.20 mg/100g
Energy	317 Kcal /100g		

(El-Sohaimy and Hafez,2010)

Phytochemicals

Date fruit are good sources of iron and potassium; a fair source of calcium, chlorine, copper, magnesium, and sulfur; and a minor source of phosphorus. In addition, dates are a source of 16 amino acids and vitamins A, B_1, and B_2 (Ahmed et al. 1995; Vandercooket al.1980). Dates contain natural fibers, and a lot of other nutrients, like oil, calcium, sulphur, iron, potassium, phosphorous, manganese, copper, magnesium, etc. Dates have a high tannin content and are used medicinally as a detersive (having cleansing power) and astringent in intestinal troubles] As an infusion, decoction, syrup, or paste, dates may be administered for sore throat, colds, bronchial catarrh, and taken to relieve fever and a number of other complaints. One traditional belief is that it can counteract alcohol intoxication. The seed powder is also used in some traditional medicines. A gum that exudes from the wounded trunk is employed in India for treating diarrhea and genito-urinary ailments. The roots are used against toothache. The pollen yields an estrogenic principle, estrone, and has a gonadotropic effect on young rats.

(http://en.wikipedia.org/wiki/Phoenix_dactylifera accessed on 20.04.2011)

It is reported that the flavonoid glycoside and procyanidin compositions of dates of the cultivar Deglet Noor harvested at the khalal stage of maturity were characterized

using liquid chromatography-electrospray ionization-tandem mass spectrometry (LC-ESI/MS/MS). Thirteen flavonoid glycosides of luteolin, quercetin, and apigenin, 19 when considering isomeric forms, were also identified. Mass spectra indicate that both methylated and sulfated forms of luteolin and quercetin are present as mono-, di-, and triglycosylated conjugates whereas apigenin is present as only the diglycoside. LC-ESI/MS/MS spectra indicate that quercetin and luteolin formed primarily O-glycosidic linkages whereas apigenin is present as the C-glycoside (Yun Jeong Hong,et al. 2006). It is reported that two tannins are present in date palm fruits viz. the catechol tannins and free gallic acid (Mahran et al., 1976). Phytochemical investigations have revealed that the fruits contain anthocyanins, phenolics, sterols, carotenoids, procyanidins and flavonoids, compounds known to possess multiple beneficial effects. Preclinical studies have shown that the date fruits possess free radical scavenging, antioxidant, antimutagenic, antimicrobial, anti-inflammatory, gastroprotective, hepatoprotective, nephroprotective, anticancer and immunostimulant activities (Baliga et al., 2010).

Pharmacological Evidence

Phytochemical investigations have revealed that the fruits contain anthocyanins, phenolics, sterols, carotenoids, procyanidins and flavonoids, compounds known to possess multiple beneficial effects. Preclinical studies have shown that the date fruits possess free radical scavenging, antioxidant, antimutagenic, antimicrobial, anti-inflammatory, gastroprotective, hepatoprotective, nephroprotective, anticancer and immunostimulant activities. Saafi et al (2010) investigated the role of date palm fruit extract (Phoenix dactylifera L.) in protection against oxidative damage and hepatotoxicity induced by subchronic exposure to dimethoate (20mg/kg/day). Pretreatment with date palm fruit extract restored the liver damage induced by dimethoate, as revealed by inhibition of hepatic lipid peroxidation, amelioration of SOD, GPx and CAT activities and improvement of histopathology changes. The present findings indicate that in vivo date palm fruit may be useful for the prevention of oxidative stress induced hepatotoxicity.

Rock et al (2009), in an in-vitro study observed that basal serum oxidative status was decreased by 33%, after consumption of dates as compared to the levels observed before consumption. Similarly, the susceptibility of serum to AAPH-induced lipid peroxidation decreased by 12%, only after Hallawi date consumption. In agreement with the above results, serum activity of the HDL-associated antioxidant enzyme paraoxonase 1 (PON1) significantly increased, by 8%, after Hallawi date consumption. They concluded that date consumption by healthy subjects, despite their high sugar content, demonstrates beneficial effects on serum triacylglycerol and oxidative stress and does not worsen serum glucose and lipid/lipoprotein patterns, and thus can be considered an antiatherogenic nutrient .

Sabah et al (2010) reported that date palm pit extract has demonstrated positive antiviral results (this effect was rapid, dose dependent, and appeared to be related to the adsorption stage of the phage replication cycle). They concluded that a further

phytochemical characterization of the active ingredients may reveal useful compounds, and may also provide the basis for further refinement of antiviral drug design and development as potential biotherapeutic agents against medically-important viruses, such as the human immunodeficiency virus (HIV).

Results of experiments conducted on rat models by Al-Qarawi et al (2005) indicated that the aqueous and ethanolic extracts of the date fruit and, to a lesser extent, date pits, were effective in ameliorating the severity of gastric ulceration and mitigating the ethanol-induced increase in histamine and gastrin concentrations, and the decrease in mucin gastric levels. The ethanolic undialyzed extract was more effective than the rest of the other extracts used. They postulated that the basis of the gastroprotective action of date extracts may be multi-factorial, and may include an anti-oxidant action.

Health Benefits

Date palm fruits contains a variety of B-complex vitamins B1, B2, Nicotinic acid and vitamin A. These vitamins have a variety of functions that help maintain a healthy body – to metabolize carbohydrates and maintain blood glucose levels, fatty acids for energy, and they help make hemoglobin, the red and white blood cells. Magnesium and calcium are essential for healthy bone development and for energy metabolism. Iron is essential to red blood cell production. Red blood cells carry all the nutrients to cells throughout the body. Dates are fat and cholesterol free and contain an ideal amount of sodium. Today's healthy diets recommend eating foods that are low in sodium, fat, cholesterol and high in fiber. Dates fit perfectly into a healthy lifestyle. Hence it is help to regulate bowel movements and aid constipation. It can be used as natural laxatives for those suffering from constipation. The date fruits great as an energy snack as they contain natural sugars like glucose, fructose and sucrose that help to provide the body with instant energy. Dates are also a great source of potassium, a nutrient that is great in the maintenance of a healthy nervous system and in balancing the body's nervous system. Phosphorus works with calcium to help with bone strength and growth, potassium that helps to keep your muscles working correctly and selenium is important for cell growth and repair. The date palm fruits provide unique functional and nutritional values. Numerous health benefits beyond its nutritional value have been associated with consuming date palm fruits to enriched nutrition values of different kinds of food. Dates could have an important all-round role to play in dietary health. There is every possibility that they contain other components that may have useful functional properties.(El-Sohaimy S.A. and Hafez E.E., 2010 [1]).

Curative Properties

1. Date as lactagogue: Dates contain Potassium; Glycine and Threonine; which activate the milk hormone (prolactin). Dates acts as lactagogue if it is used in daily feeding of a woman in her lactation period.

2. Date and tumors: Feeding on Dates increases the body immunity and resistance to cancer diseases. Estron hormone is extracted from date kernels (seeds) and treated chemically to obtain 'stradiol' which can be used for cancer treatment.

3. Date and abscesses: Dates paste and margarine is applied externally on the abscesses. The remedy is analgesic and a local antipyretic.

4. Date and skin allergy: Dates paste in water is antihistaminic, the remedy is externally applied to the skin. Food containing Dates is effective in allergy. Zinc is the active ingredient inducing allergic inhibition.

5. Date and chest infection: Dates are used as a remedy for throat and chest infections

6. Date and hemorrhoids: The continuous feeding on Dates relieves the hemorrhoids pains and increases the body resistance to this disease. The calcium, phosphorus and iron of dates are active ingredients in treatment of hemorrhoids.

7. Date and dermatitis: A medicinal soap made of powdered date stones, fats, alkali and antimicrobial substance is used for treatment of skin allergy and acrodermatitis.

8. Date and gout: A researches on Dates stones (seeds) were carried out in Egyptian Institute of Medicinal researches revealed that a coffee made from powdered Dates stones drunk twice daily relieves the gout pains.

9. Date and bronchial asthma: Drinking of **d**ecoction of Dates and fenugreek twice daily is recommended in the treatment of bronchial asthma.

10. Date and hyperacidity: Dates when added to the food gets rid of stomach hyperacidity as,well as blood acidity.

11. Date and renal disorder: Dates is a renal restorative; its daily consumption prevents the formation of renal calculei due to its diuretic and anti-inflammatory actions.

12. Date and night blindness: the daily consumption of Dates in meals and its decoction as eye-lotion help in maintenance of eye hygiene and remedy curative to the night blindness and ophthalmia.

(http://datesindia.com/medicinaluses.html)

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15. POMEGRANATE (*Punica granatum* L.)

Pomegranate *(Punica granatum* L.) belongs to the family Punicaceae and is one of the favaourite table fruits of tropical and subtropical regions. The fruit is in fact native to Iran and is extensively cultivated in Mediterranean countries..

Uses

The pomegranate is commercially grown for its sweet acidic taste.The fresh fruit has exquisite quality, while its processed products such as bottled juice, syrups and jelly are highly appreciated. Pomegranate is a delicious fruit consumed for its medicinal value. Its juice sweet with pleasant aroma and is refreshing. The fruit is widely used for Ayurvedic and Unani medicines. Some of the commercial products of pomegranates are juice, squash, syrup, jelly. Anardana is obtained by drying the seed along with pulp and sun . The rind is used as a valuable tanning material. The flowers yield a red dye.

Nutritional Composition of pomegranate (per 100 g of edible portion)

Component	**Quantity per 100 g**	**Component**	**Quantity per 100 g**
Moisture	78.0 g	Magnesium	12 mg
Carbohydrates	14.5 g	Phosphorus	70 mg
Protein	1.6 g	Oxalic acid	14 mg
Fat	0.1 g	Ascorbic acid	22 mg
Fibre	5.1 g	Total sugars	10.6 g
Mineral	0.7 g	Tannin	0.12 g
Calcium	10 mg	Ash	0.52 g

(Bose and Mitra*.,* 1990)

Phytochemistry

The therapeutic properties are reportedly due to the presence of betulic acid and ursolic acid and different alkaloids like pseudopelletierine, pelletierine, isopelletie, methyl pelletierine and other basic compositions. The seeds have esterogenic activity due to presences of steroidal esterogens. The pomegrante juice contains Ellagitannins, Pelargonidin, Punicalin, Punicalagin, Anthocyanins, Cyanidin and Ellagic Acid. Other phytochemicals reported in different parts of the fruit like peel, seeds, etc. are quercetin,

rutin, punicic acid, phenolic punicalagins, gallic acid, cachetin and tannins (punicalin, punicafolin), triterpenoids including maslinic and Asiatic acid (Jurenka, 2008).

Pharmacology

Pomegranate contains high levels of antioxidants and phytochemicals with anti-inflammatory properties. Studies conducted to investigate the effect of a pomegranate extract inhibited cell growth and caused apoptosis of highly aggressive human prostate cancer cells. Consumption of pomegranate may retard prostate cancer progression and may prolong the survival of prostate cancer cells (Malik A, Mukhtar H.2006). Pomegranate juice has been shown to contain polyphenol antioxidants (primarily ellagic acid and punicalagin) that may lower risk of heart disease (Aviram et al., 2004) and may slow cancer progress (Adams et al., 2006). The antioxidant content of pomegranate juice is among the highest of any foods (Guo et al., 2003).

Pomegranate juice, total pomegranate ellagitannins, and punicalagin are also reported to suppress inflammatory cell signaling in colon cancer cells. Phytochemicals from pomegranate may inhibit cancer cell proliferation and apoptosis. These phytochemicals act by modulating the cellular transcription factors and signaling proteins. Other studies showed that pomegranate juice and its ellagitannins inhibited proliferation and induced apoptosis of colon cancer cells. The researchers concluded that polyphenols in pomegranate can play an important role in the modulation of inflammatory cell signaling in colon cancer cells (Malik and Mukhtar, 2006).

Anticancer activities of pomegranate extracts and genistein in human breast cancer cells was investigated by some workers. The scientists tested the potential anticancer effects of pomegranate extracts and genistein on the inhibition of cell proliferation and induction of apoptosis in human breast cancer cells. They found that pomegranate extracts and genistein were cytotoxic to the cancer cells and they inhibited their growth. The combined treatment of pomegranate extracts and genistein was more effective than the single treatments (Jeune et al, 2005).

Pomegranate byproduct administration to apolipoprotein e-deficient mice attenuates atherosclerosis development as a result of decreased macrophage oxidative stress and reduced cellular uptake of oxidized low-density lipoprotein**.** After the production of pomegranate juice the left overs (mainly peels and seeds) contain useful phytochemicals. A study investigated the effects of a pomegranate byproduct on atherosclerosis development in apolipoprotein E-deficient mice. These mice are characterized by spontaneous hypercholesterolemia and accelerated atherosclerosis, which is substantially increased by high cholesterol diet. The consumption of pomegranate byproduct by the mice resulted in a significant reduction in atherosclerotic lesion size and a significantly reduced oxidative stress in the mice peritoneal macrophages. Pomegranate byproduct also decreased the oxidation of low density

lipoprotein (LDL). The researchers concluded that pomegranate byproduct significantly reduces atherosclerosis development by its antioxidant properties (Seeram et al. 2006).

Pomegranate juice reduces oxidized low-density lipoprotein downregulation of endothelial nitric oxide synthase in human coronary endothelial cells, which suggested that pomegranate juice has indeed a beneficial effects on the evolution vascular health and coronary heart disease.

Beta secretase initiates the plaque development in the brain, which might result in dementia. The scientists were looking for beta-secretase inhibitors in the husk of pomegranate. They identified the phytochemicals ellagic acid and punicalagin which were less inhibitory to alpha-secretase and other serine proteases, indicating that they were relatively specific inhibitors of beta-secretase.
(http://www.phytochemicals.info/abstracts/pomegranate-heart-disease.php)

Everyone knows that cholesterol causes heart diseases and tries to limit cholesterol intake. But a more important cause of fatty buildups in the arteries is the oxidation of low-density lipoprotein cholesterol. The use of dietary supplements of antioxidants could reduce the risk of cardiovascular disease, but there is no hard evidence. At this stage, studies only show that the intake of foods, naturally rich in antioxidants reduces this risk. Urolithin may also have biological effects and may be partially responsible for the health benefits of pomegranate.

Not only the pomegranate fruit contains phytochemicals with antioxidant activity, but also the pomegranate flowers. For this study, alcoholic extracts from the pomegranate flowers was analyzed. The extract contained high quantities of polyphenols with potential antioxidant ability. These results indeed indicated that pomegranate flower extract demonstrated a significant antioxidant activity in vitro. In vivo tests with mice showed that a pre-treatment with pomegranate flower extract reduced oxidative stress and injury of the liver. The study concluded that pomegranate flower extract possesses a potent antioxidant and hepatoprotective activity. (Kaur et al, 2006).

Ellagitannins are polyphenols, which hydrolyse into ellagic acid. The main ellagitannin present in pomegranate juice is punicalagin. In-vitro studies have shown that the ellagitannins from pomegranate juice have many health promoting benefits, but these are of little use if the ellagitannins are not absorbed. Pomegranate extract have been shown to inhibit the proliferation of human cancer cells and to cause cancer cell apoptosis. The researchers found ellagic acid in the serum and metabolites in the urine. The ellagic acid levels in serum increased within hours but disappeared rather quickly. The ellagic acid metabolite dimethylellagic acid glucuronide seemed to be a good indicator of intake of ellagic acid, because it was found in 15 of the 18 volunteers and within 1 day or intake of pomegranate juice. In addition, the microbiological metabolite urolithin-glucoronide was found in the urine.

Medicinal Benefits and Curative Properties

- **Diarrhoea**
  Pomegranate juice is a mild astringent, used to treat diarrhoea, and reduces some fevers.

- **Anti-parasites**
  The root bark is used to treat intestinal parasites, mainly tapeworm. The alkaloids narcotise the tapeworms so they lose their grip to the intestinal wall and are expelled. These alkaloids are also very toxic so they should not be used for self-medication.

- **Antioxidant**
  Pomegranate contains many phytochemicals with antioxidant action, such as ellagic acid. Ellagic acid has anticarcinogenic, antiatherogenic and antifibrosis activity.

- **SkinWhitening**

Studies have shown that ellagic acid can suppress UV-induced skin pigmentation when applied topically or when administered orally. Mineka Yoshimura and colleagues have shown in their study "Inhibitory Effect of an Ellagic Acid-Rich Pomegranate Extract on Tyrosinase Activity and UV-induced Pigmentation" (Bioscience, Biotechnology, Biochemistry, 2005) that pomegranate extract has skin-whitening property. This effect was probably caused by the inhibition of proliferation of melanocytes and melanin synthesis.(http://food-acts.suite101.com/article.cfm/medicinal_properties_of_the_pomegranate).

- The pomegranate is considered a good tonic for the heart.

- It reduces the systolic pressure, and thus keeps blood pressure under control.

- A pomegranate enhances the functions of the kidney and liver, and is used to treat spleen enlargement. Moreover, it supplies minerals and helps the liver to absorb vitamin A from the food.

- The sweet variety is useful as a laxative. The sweet and sour variety alleviates heartburn and stomach inflammations.

- The antioxidants in the juice boost immunity, and increase resistance to diseases, specially TB and cancer. Studies have shown that the pomegranate can be used to treat cancers of the lung, prostrate and breast.

- The juice also has antiseptic properties, and is useful in alleviating fevers. Moreover, it used for healing cuts.

- Due to its astringent properties, it is also beneficial in diarrhea and dysentery.

- The juice is used as a digestive and appetizer, and is useful in colitis. When mixed with honey, it can alleviate nausea and vomiting, specially during morning sickness. This combination is also used in folk medicine to enhance the memory.

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16. BAEL (*Aegle marmelos*, L)

Bael (Aegle marmelos, L.) is an important indigenous fruit of India. The importance of bael fruit lies in its curative properties. Besides India, bael is also grown in Sri Lanka, Pakistan, Bangladesh, Burma, Thailand and most of the South-East Asian countries.

Uses

Bael fruits may be cut in half, or the soft types broken open, and the pulp, dressed with palm sugar, eaten for breakfast, as is a common practice in Indonesia. The pulp is often processed as nectar or "squash" (diluted nectar). A popular drink (called "sherbet" in India) is made by beating the seeded pulp together with milk and sugar. A beverage is also made by combining bael fruit pulp with that of tamarind. These drinks are consumed perhaps less as food or refreshment than for their medicinal effects.

Mature but still unripe fruits are made into jam, with the addition of citric acid. The pulp is also converted into marmalade or sirup, likewise for both food and therapeutic use, the marmalade being eaten at breakfast by those convalescing from diarrhea and dysentery. A firm jelly is made from the pulp alone, or, better still, combined with guava to modify the astringent flavor. The pulp is also pickled.

The young leaves and shoots are eaten as a vegetable in Thailand and used to season food in Indonesia. They are said to reduce the appetite. An infusion of the flowers is a cooling drink. (Morton, 1987).

Therapeutically active principle of bael fruit is marmelosin. Fruit rind yields tannin. Mucilaginous substances secreted around the seeds is used in varnishes and also as adhesive. Fruit is used widely in chronic diarrhoea and dysentery. Sherbet is prepared from ripe fruits. Half- ripe fruit is used as an astringent and digestive.

Composition of ripe bael;(par 100 g of edible portion)

Component	**Quantity**	**Component**	**Quantity**
Moisture	54.96-61.5 g	Phosphorus	50 mg/100 g
Carbohydrates	28.11-31.8 g	Iron	0.6 mg/100 g
Protein	1.8-2.62 g	Thiamine	0.13 mg/100 g
Fat	0.2-0.39 g	Riboflavin	1.19 mg
Mineral	1.04-1.7 g	Carotene	55 mg
Fibre	2.90 g/ 100 g	Niacin	1.1 mg/100 g
Energy	137 Kcal/100 g	Vitamin C	8-60 mg
Calcium	85 mg/100 g		

(Gopalan, 1985**,** Morton, 1987)

Phytochemicals

Numerous phytochemical and pharmacological studies have been conducted on different parts of *Aegle marmelos.* The present literature supports the potential of *Aegle marmelos* as a medicinal tree. The pulp also contains a balsam-like substance, and 2 furocoumarins-psoralen and marmelosin ($C_{13}H_{12}O_3$), highest in the pulp of the large, cultivated forms.

There is as much as 9% tannin in the pulp of wild fruits, less in the cultivated types. The rind contains up to 20%. Tannin is also present in the leaves, as is skimmianine (Morton, 1987).

Bael is reported to contain a number of coumarins, alkaloids, sterols and essential oils. Roots and fruits contain coumarins such as scoparone, scopoletin, umbelliferone, marmesin and skimmin. Fruits, in addition, contain xanthotoxol, imperatorin and alloimperatorin and alkaloids like aegeline and marmeline identified as (N-2- hydroxy-2-[4 - (3',3'-dimethyl allyloxy) phenyl] ethyl cinnamide. b- sitosterol and its glycoside are also present in the fruits. Roots and stem barks contain a coumarin - aegelinol. Roots also contain psoralen, xanthotoxin, 6,7- dimethoxy coumarin, tembamide, mermin and skimmianine. Leaves contain the alkaloids - O-(3,3- dimethyl allyl)-halfordinol, N-2-ethoxy-2 (4-methoxy phenyl) ethyl cinnamide, N-2-methoxy-2-(4-3',3'-dimethyl allyloxy) phenyl] ethyl cinnamide, N- 2- [4-(3',3'-dimethyl allyloxy) phenyl] ethyl cinnamide, N-2-hydroxy-2-[4-(3',3'- dimethyl allyloxy) phenyl] ethyl cinnamide, N-4-methoxy steryl cinnamide and N-2-hydroxy-2-(4- hydroxy phenyl) ethyl cinnamide. Mermesinin, rutin and b-sitosterol - b-Dglucoside are also present in the leaves (Husain et al. 1992). A series of phenylethyl cinnamides, which included new compounds named anhydromarmeline (Joy et al. 1998), aegelinosides A and B were isolated from Aegle marmelos leaves as alfaglucosidase inhibitors. The structures of new compounds were characterized by spectroscopic data and chemical degradation of compounds isolated, anhydroaegeline (Husain et al. 1992) revealed the most potent inhibitory effect against alfaglucosidase with IC50 value of 35.8 lM.

Experiments clearly revealed the structure of this hemicellulose (Ratan et al.1982). The homogeneous, neutral polysaccharide isolated from the crude polysaccharide of the fruit pulp from bael (*Aegle marmelos*) contains arabinose, galactose, and glucose in the molar ratios of 2:3:14. In addition to marmenol, several known compounds have also been obtained for the first time from the same source. They include: praealtin D, trans-cinnamic acid, valencic acid, 4-methoxy benzoic acid, betulinic acid, N-pcis- and trans-coumaroyltyramine, montanine, and rutaretin.(Vijay et al., 2010).

Pharmacology

The data collected on administration of different levels of leaf extracts of *A. marmelos* demonstrated that it has a high margin of drug safety (Vijay et al., 2010;Veerappan et al.2007). Identification of one or more antihistaminic constituents present in the alcoholic extract of this plant, supported the traditional use of *A. marmelos* in asthmatic complaints (Arul et al., 2004). At 100 ng/ml concentration the methanolic extract of the leaves showed complete loss of motility of microfilariae after 48 hrs of incubation. Thin layer chromatography of the extracts revealed the presence of alkaloid, coumarin in the leaves of *Aegle marmelos Corr (* Sahare et al., 2008**).** A new

anthraquinone, 1-methyl-2-(3′- methyl-but-2′-enyloxy)-anthraquinone (Joy et al., 1998) was isolated from seeds of Aegle marmelos Correa which exhibited significant antifungal activity against pathogenic strains of Aspergillus species and Candida albicans. The methanol extract of leaves of *Aegle marmelos* at a dose level of 200 and 300 mg/kg showed significant analgesic activity on acetic acid-induced writhing and tail flick test in mice (Shankaranath et al., 2007**).**

The most of the extracts derived from the plant Aegle marmelos caused a significant inhibition of the carrageenan-induced paw oedema and cotton-pellet granuloma in rats. The extracts also produced marked analgesic activity by reduction of the early and late phases of paw licking in mice. A significant reduction in hyperpyrexia in rats was also produced by the most of the extracts. This study was established anti-inflammatory, antinociceptive and antipyretic activities of the leaves of Aegle marmelos (Arul et al., 2005**).** From the leaves of *A. marmelos* an alkaloidal-amide, Aegeline 2, was isolated and found to have antihyperglycemic activity as evidenced by lowering the blood glucose levels by 12.9% and 16.9% at 5 and 24 h, respectively, in sucrose challenged streptozotocin induced diabetic rats (STZ-S) model at the dose of 100 mg/kg body weight. Aegeline 2 has also significantly decreased the plasma triglyceride (Tg) levels by 55%, total cholesterol (TC) by 24%, and free fatty acids (FFA) by 24%, accompanied with increase in HDL-C by 28% and HDL-C/TC ratio by 66% in dyslipidemic hamster model at the dose of 50 mg/kg body weight. Extracts from *Aegle marmelos* Correa were found to be able to inhibit the *in vitro* proliferation of human tumor cell lines, including the leukemic K562, T-lymphoid Jurkat, Blymphoid Raji, erythroleukemic HEL, melanoma Colo38, and breast cancer MCF7 and MDAMB- 231 cell lines (Vijay et al., 2010). The extract facilitated the healing process as evidenced by increase in the tensile strength in the incision model. The results were also comparable to those of a standard drug itrofurazone (Jaswant et al., 2001**).** The aqueous extract of A.marmelos revealed cardiac stimulant,smooth-muscle relaxant and uterine stimulant properties (Vijay et al., 2010).

Medicinal Value and Curative Properties

The bael tree is one of the most useful medicinal plants of India Its medicinal properties have been described in. the ancient medical treatise in Sanskrit, *Charaka Samhita* All the parts of this tree including stem, bark, root, leaves and fruit at all stages of maturity has medicinal virtues and has been used as traditional medicine for a long time.

The fruit is of considerable medicinal value when it just begins to ripen. The ripe fruit is aromatic, astringent which helps construction of skin, coolant and laxative. The unripe or half-ripe fruit is astringent, digestive stomachic which improves appetite and anti scorbutic, i.e. which helps to fight scurvy caused due to vitamin C deficiency.

Several research reports are available on medicinal properties of bael which are enumerated below (Vinodini et al., 2007) .

The leaves of *Bael* are astringent, a laxative, and an expectorant and are useful in treatment of ophthalmia, deafness, inflammations, cataract, diabetes, diarrhoea, dysentery, heart palpitation, and asthmatic complications (Kirtikar and Basu, 1993). It has been claimed the leaf of *Aegle marmelos* posses contraceptive efficacy (Bhattacharyay, 1982). Fresh aqueous and alcoholic leaf extracts of *Aegle marmelos* were reported to have a cardio tonic effects in mammals (Haravey, 1968 ; Nadkarni, 2000). *Aegle marmelos* leaf extract has been reported to regenerate damaged pancreatic beta cells in diabetic rats (Das et al., 1996) and increased the activities of peroxidase in the liver tissues of Isoproterenol treated rats (Rajadurai et al., 2005). An aqueous decoction of the leaves has been shown to possess a significant hypoglycemic effect (Karunanayeke et al., 1984). *Aegle marmelos* leaf extract was found to be apotential antioxidant drug, which reduces the blood sugar level in alloxan induced diabetic rats (Sabu and Ramadasan, 2004). It was found to be as effective as insulin in the restoration of blood glucose and body weight to normal levels on hyperglycemic state (Seema et al., 1996). The ethanolic extract of *Aegle marmelos* leaf possesses anti spermatogenic activity (Sur et al., 1999) and aqueous extract of the leaf has anti motility action on spermatozoa in rats (Sur et al., 2002).

Home Remidies of Aegel marmelos

Constipation :- Ripe bael fruit is regarded as best of all laxatives. It cleans and tones up the intestines. Its regular use for two or three months helps evacuate even the old accumulated faecal matter from the bowels. For best results, it should be taken in the form of *sherbat,* which is prepared from the pulp of the ripe fruit.

Diarrhea and Dysentery :- The unripe or half ripe fruit is perhaps, the most effective food remedy for chronic diarrhea and dysentery where there is no fever. Best results are obtained by the use of dried bael or its powder The bael fruit, when it is still green, is sliced and dried in the sun. The dried bael slices are reduced into powder and preserved in air-tight bottles. The unripe bael can also be baked and taken with jaggery or brown sugar The fruit appears to have little effect in acute dysentery when there is definite sensation to defecate but instead of significant amount of faeces, blood and mucus alone are passed The powdered drug is specially recommended in this condition. Its beneficial effect is, however, most evident when the condition has become sub-acute or chronic After the use of the fruit in these conditions, the blood gradually disappears and the stool assume a more feculent and solid form. The mucus also disappears after continued use for some time It is also a valuable remedy for chronic dysenteric conditions characterized by alternate diarrhea and constipation.

- **Peptic Ulcer** :- An infusion of bael leaves is regarded as an effective food remedy for peptic ulcer. The leaves are soaked overnight in water. This water is strained

and taken as a drink in the morning The pain and discomfort are relieved when this treatment is continued for a few weeks. Bael leaves are rich in tannins which reduce inflammation and help healing of ulcers. The bael fruit taken in the form of beverage has also great eating properties on account of its mucilage, i *e* sticky or viscous content This substance forms a coating on the stomach mucous and thus helps in the healing of ulcers.

- **Respiratory Affections** :- A medicated oil prepared from bael leaves gives relief from recurrent colds and respiratory affections. The juice extracted from bael leaves is mixed with equal quantity of sesame oil and heated thoroughly A few seeds of black pepper and half a teaspoonful of black cumin are added to the hot oil It is then removed from the fire and stored for use when necessary. A teaspoonful of this oil should be massaged into the scalp before a head bath. Its regular use builds up resistance against colds and coughs. A common practice in south India is to give the juice of bael leaves to bring relief from wheezing and respiratory spasm. The leaf juice, mIxed in warm water with a little pepper, is given as a drink.

- A bitter, light-yellow oil extracted from the seeds is given in 1.5 g doses as a purgative. It contains 15.6% palmitic acid, 8.3% stearic acid, 28.7% linoleic and 7.6% linolenic acid. The seed residue contains 70% protein.

- The bitter, pungent leaf juice, mixed with honey, is given to allay catarrh and fever. With black pepper added, it is taken to relieve jaundice and constipation accompanied by edema. The leaf decoction is said to alleviate asthma. A hot poultice of the leaves is considered an effective treatment for ophthahnia and various inflammations, also febrile delirium and acute bronchitis.

- A decoction of the flowers is used as eye lotion and given as an antiemetic. The bark contains tannin and the cournarin, aegelinol; also the furocourmarin, marmesin; umbelliferone, a hydroxy coumarin; and the alkaloids, fagarine and skimmianine. The bark decoction is administered in cases of malaria. Decoctions of the root are taken to relieve palpitations of the heart, indigestion, and bowel inflammations; also to overcome vomiting.

- The fruit, roots and leaves have antibiotic activity. The root, leaves and bark are used in treating snakebite. Chemical studies have revealed the following properties in the roots: psoralen, xanthotoxin, *O*-methylscopoletin, scopoletin, tembamide, and skimmin; also decursinol, haplopine and aegelinol, in the root bark.

http://www.best-home-remedies.com/herbal_medicine/ fruits/bael.htm)

http://www.hort.purdue.edu/newcrop/morton/bael_fruit.html)

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ANNONACEOUS FRUITS

Annona contains more than fifty species of woody shrubs and trees, all of which produce aggregate fleshy fruits. Of all these *Annona squamosa* L. is probably the most popular fruit. Othe species of the genus *Annona* providing edible fruits are *A.reticulata* L., *A.muricata* L., and *A.cherimola* L.

17. Custard Apple (*Annona squamosa* Linn)

The custard apple, Annona squamosa L., also known as sweet-sop or sugar apple, is almost entirely eaten as a dessert fruit. Its pulp may be mixed with milk to form drink or made into ice-cream. The pulp has a pleasant texture and flavour. Several products like -squash, nectar, pulp butter, syrup, jam can be made from the pulp.

Nutritional Composition of ripe custard apple fruit (per 100g of pulp)

Component	**Quantity**	**Component**	**Quantity**
Moisture	70.50 g /100 g	Calcium	17.00 mg /100 g
Carbohydrates	23.50 g /100 g	Phosphorous	47.00 mg /100 g
Protein	1.60 g /100 g	Iron	1.50 mg /100 g
Fat	0.40 g /100 g	Thiamine	0.07 mg /100 g
Mineral	0.90 g /100 g	Riboflavin	0.17 mg /100 g
Fibre	3.10 g /100 g	Niacin	1.30 mg /100 g
		Ascorbic acid	37.00 mg /100 g

(Bose and Mitra, 1990)

Phytochemicals

The unripe fruit, seed, leaf and root have medicinal and insecticidal properties. The alkaloid present is ancorin. Leaves, stem and other portions are bitter due to annonanine. Custard apple contains no sodium they are high in carbohydrates and rich in calcium, vitamin C and phosphorus, and with a sugar content of about 50-50 (glucose and sucrose). This fruit is also considered as a good tonic in Ayurveda. It enriches blood and is known to increase muscular strength.

The root bark is considered an antidote for snakebite and is used by Nigerian medicine men as a cancer remedy. Investigations have revealed antitumor activity against sarcoma 180 ascites, and antibiotic activity. The trunk bark contains alkaloids, including

0.02% anonaine, also tannins and saponins. The leaves contain rutin, quercetin and quercetrin (Morton, 1987).

Leaves contains 4-(2-nitroethyl)- 1-((6-O-ß-D-xylopyranosyl-ß-Dglucopyranosyl)- oxy)benzene, Anonaine, Benzyltetrahydro-isoquinoline, Borneol, Camphene, Camphor, car-3-ene, Carvone, ß-Caryphyllene, Eugenol, Farnesol, Geraniol, 16-Hentriacontanone, Hexacontanol, Higenamine, Isocorydine, Limonine, Linalool, Linalool acetate, Menthone, Methylanthranilate, Methylsalicylate, Methylheptenone, p-(hydroxybenzyl)-6,7-(2-hydroxy,4-hydro)isoquinoline, n-Octacosanol, á-Pinene, ß-Pinene, Rutin, Stigmasterol, ß-Sitosterol, Thymol and n-Triacontanol (Jayshree D. Patel and Vipin Kumar, 2008**).**

The isolation from the seeds is reported of a saponin, identified as stigmasta-5,24(28)-dien-3-β-ol-α-L-rhamnoside (Saluja et al., 1990).

The leaf of *Annona squamosa has* been reported to contain essential oil, terpenes, alkaloids-anonaine, roemerine, corydine, norcorydine, isocorydine and norisocorydine. The insecticidal activity appears to be due to the presence of its active principles (Kumar *et al.,*2010).

Phytochemical investigation of Annona squamosa twigs, resulted in isolation and identification of twelve known (1-12) compounds among them one 1-(4-β-D-glucopyranosyloxyphenyl)-2-(β-D-glucopyranosyloxy)-ethane (11) is synthetically known but first time isolated from natural sources (Yadav et al., 2011).

Pharmocological Evidence of its medicinal properties

Acetogenin a different class of secondary metabolites was found in various parts of *Annona squamosa* L. More than 20 different acetogenins were isolated from leaves, bark, fruits and seeds. Cytotoxic and Insecticidal properties of Annona squamosa L. were attributed to acetogenins. More than 13 different alkaloids, several terpenes, kauranes were isolated. Antibacterial activity was attributed to terpenes and kauranes. Seeds of Annona squamosa yielded fixed oil containing hydroxyacids. Seeds were found to contain anti-inflammatory cyclic peptides.Many pharmacological activities were experimentally reported on extracts of Annona squamosa L., these included Antitumour, Cytotoxic, Anti-inflammatory, Analgesic, Antidiabetic, Antioxidant, Larvicidal, Insecticidal, Molluscicidal, Licicidal, Antibacterial, Nutritive, Antihtyroid (Jagtap et al., 2009).

The plant is traditionally used for the treatment of epilepsy, dysentery, cardiac problems, worm infestation, constipation, hemorrhage, antibacterial infection, dysuria, fever, and ulcer. It also has antifertility, antitumor and abortifacient properties. Ethanolic extracts of leaves and stem are reported to have an anticancerous activity. In this review, we have explored the Phyto-pharmacological properties of the *A.squamosa* plant and

compiled its vast pharmacological applications to comprehend and synthesize the subject of its potential image of multipurpose medicinal agent (Saleem et al., 2009).
The Annona squamosa L. bark was collected from Ahmednagar district, India. 18-Acetoxy-ent-kaur-16-ene was isolated from petroleum ether extract (PE) and studied for its analgesic and anti-inflammatory activities. 18-Acetoxy-ent-kaur-16-ene at the doses of 12.5 and 25 mg/kg, and PE at a dose of 50 mg/kg exhibited significant analgesic along with anti-inflammatory activity. (Chavan et al., 2009).

The investigation was made to reveal the involvement of a quercetin in the antidiabetic and antiperoxidative effects of Annona squamosa leaf extract. Quercetin-3-O-glucoside (characterized by UV, IR, MS and NMR analyses) was isolated from Annona squamosa leaves and examined for its potential to regulate alloxan-induced hyperglycemia and lipid peroxidation (LPO) in rats. While in alloxan treated animals, an increase in the concentration of serum glucose with a parallel decrease in insulin level was observed, administration of 15 mg/kg/day of isolated quercetin-3-O-glucoside for 10 consecutive days to the hyperglycemic animals reversed these effects and simultaneously inhibited the activity of hepatic glucose-6-phosphatase. It further decreased the hepatic and renal LPO with a concomitant increase in the activities of antioxidative enzymes, such as catalase (CAT) and superoxide dismutase (SOD) and in glutathione (GSH) content, indicating its safe and antiperoxidative effects. These findings suggest the potential of quercetin-3-O-glucoside in the amelioration of diabetes mellitus and tissue lipid peroxidation. It also appears that the antidiabetic effects of A. squamosa leaf extract is possibly mediated through the insulin stimulating and/or free radical scavenging properties of its active constituent, quercetin-3-O-glucoside (Panda and Kar, 2007).

Medicinal Benefits and Curative Properties

- The decoction made out the leaves of this plant serve as vermifuge.
- Paste of flesh of this plant or crushed leaves of the plant can be used for local application on ulcers, abscesses and boils.
- The fruit of the plant, in its unripe form, can be dried, crushed and used for treating diarrhea and dysentery.
- The decoction of the bark of the plant could be used in the form of tonic for dysentery and diarrhea remedy. In case, the condition is serious, the bark, the leaves and green fruits are boiled together in a litre of water for five minutes, and the decoction can be given to the patient. Decoction of the leaves and/or root is also taken in cases of dysentery.
- The root bark of the tree is used for relief from toothache.
- The decoction extracted from the root serve as febrifuge.

- The fruit of the plant, serves as an expectorant, stimulant, coolant, haematinic, and is useful in treating anemia.
- The seeds of the plant have insecticidal and abortifacient properties.
- The leaves served as a purgative.
- Decoction of the leaves is good to cure diabetes.
- The leaves are applied to abscesses and open wounds and used to cure skin itches.
- The crushed leaves are sniffed to overcome fainting spells and hysteria,
- The mashed, ripe fruit, mixed with salt, is applied on tumors.
- Decoction of the leaves is used to aid digestive problem, and to treat colds.
- Decoction of the leaves is employed in baths to alleviate rheumatic pain
- Decoction of the leaves is used to clarify urine.
- The seeds immerse in coconut oil is a traditional treatment for head and body lice. The seed is also made into powder and can be applied on head to kill lice in hair.

(Source : http://hubpages.com/hub/Medicinal-Uses-of-Sugar-Apple **&** Padhi et al., 2011**)**

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18. Cherimoya (*Annona cherimola*, Mill.)

Cherimoya is considered as the most esteemed of the fruits of the genus *Annona* (family Annonaceae), the cherimoya, *A. cherimola* Mill., because of its limited distribution, has acquired few colloquial names, and most are merely local variations in spelling, such as *chirimoya, cherimolia, chirimolla*, *cherimolier, cherimoyer*. The cherimoya is believed indigenous to the interandean valleys of Ecuador, Colombia and Bolivia.

It bears fruits with skin which is thin or thick, may be smooth with fingerprint-like markings or covered with conical or rounded protuberances. The sweet, juicy, white flesh is melting, subacid and very fragrant. The fruit is of a primitive form with spirally arranged carpels, resembling a raspberry. Each segment of flesh surrounds a single hard black bean-like seed.

Uses

The flesh of the ripe cherimoya is most commonly eaten out of-hand or scooped with a spoon from the cut open fruit. It really needs no embellishment but some people in Mexico like to add a few drops of lime juice. Occasionally it is seeded and added to fruit salads or used for making sherbet or ice cream. Colombians strain out the juice, add a slice of lemon and dilute with ice-water to make a refreshing soft drink. The fruit has been fermented to produce an alcoholic beverage (Morton, 1987). In Jamaica, the dried flowers have been used as flavoring for snuff.

Nutritional Composition of Cherimoya fruit

Component	**Quantity**	**Component**	**Quantity**
Moisure	76.40 g/100 g	Calcium	30 mg/100 g
Carbohydrates	20.20 g/100 g	Phosphorus	20 mg/100 g
Protiens	1.30 g/100 g	Iron	0.40 mg/100 g

Fats	0.30 g/100 g	Thiamine	0.03 mg/100 g
Fibre	1.50 g/100 g	Riboflavin	0.21 mg/100 g
Minerals	0.30 g/100 g	Vitamin C	7.0 mg/100 g
Energy	89 Kcal/100 g	Niacin	1.0 mg/100 g

(Gopalan, et al.,. 1985)

Phytochemicals

All species of ***Annona*** can produce seed oil. Essential oils extracted from soursop (pulp) have industrial applications and the oils are also thought to improve the flavour of processed fruit products. A large number of chemical compounds, including flavonoids, alkaloids and acetogenins, have been extracted from annona seeds and many other parts of the plant. Flavonoids and alkaloids have shown insecticidal and antibacterial properties, and have been used for treatment of medical conditions, such as skin disease, intestinal worms and inflammation of the eye. All species are used in traditional folk medicine, however pharmaceutical products have been developed for the international market. Acetogenins are thought to have anti-HIV and anti-cancer effects. A wide variety of products have been developed and are available for cancer treatment*. Research is on-going in these areas and although there have been some promising results, further research is necessary. Seven acetogenins: squamocin (1), molvizarin (2), itrabin (3), almuñequin (4), cherimolin-1 (5), cherimolin-2 (6), and tucumanin (7) were isolated from Annona cherimolia Mill which were found to have insecticidal properties. (Alvarez at al, 2010 & International Centre for Underutilized Crops).

Medicinal Uses and Curative Properties (Morton, 2007; http://m.blogher.com/own-your-beauty; Padhi et al, 2011)

- In Mexico, rural people toast, peel and pulverize 1 or 2 seeds and take the powder with water or milk as a potent emetic and cathartic.
- Mixed with grease, the powder is used to kill lice and is applied on parasitic skin disorders.
- A decoction of the skin of the fruit is taken to relieve pneumonia.
- - Infusion of leaves: diabetes, soothing, pain, weight loss;
- Infusion of flowers and buds: chest, bronchitis, the cough;
- Fruit oil, in external use, rheumatism, abscesses, edema.

- Decoction of leaves or roots, remove phlegm from the lungs, cough, flu, asthma, asthenia, hypertension, diabetes, intestinal worms, heart, weight loss diets;
- Fruit oil, mixed with olive oil, externally, neuralgia, rheumatism, arthritis;
- Fruit or fruit juice, intestinal worms, fever, diarrhea.

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19. Bullock's Heart (Soursop) (*Annona muricata*, L.)

Sour-sop, *Annona muricata* L., also called as Bullock's heart, is a larger fruit than custard apple. The flesh is spinny and has a whilte fibrous flesh in which large black seeds are embedded. It is completely tropical in habitat.

Bullock's heart is used as an astringent and also as a blood complement.it has the use as an antidysentric and vermifuge. A black dye is produced from the dye unripe fruit. Seed oil is used as an insecticide and for making agriculture implement.

Uses

Soursop is used for the preparation of sherbet and other refreshing drinks. In Indonesia, the tender fruit is used as a vegetable. Seeds have insecticidal properties and leaves contain an essential oil. Excellent jelly can be prepared from soursop fruit. Unripe fruit powder is prescribed for chronic dysentery. Buds and flowers are considered to be an excellent remedy for cough.

Nutritional Composition of Sour-sop

Component	Quantity per 100 g	Component	Quantity per 100 g
Moisture	76.08 g	Calcium	0.07 mg
Carbohydrates	20.90 g	Phosphorus	0.01 mg
Protein	1.40 g	Iron	0.01 mg
Fat	0.30 g	Carotene	0.60 mg
Mineral	0.70 g		

(Morton, 1987)

Phytochemicals

Essential oils extracted from soursop (pulp) have industrial applications and the oils are also thought to improve the flavour of processed fruit products. A large number of chemical compounds, including flavonoids, alkaloids and acetogenins, have been extracted from annona seeds and many other parts of the plant. Flavonoids and alkaloids have shown insecticidal and antibacterial properties, and have been used for treatment of medical conditions, such as skin disease, intestinal worms and inflammation of the eye. All species are used in traditional folk medicine, however pharmaceutical products have been developed for the international market. Acetogenins are thought to have anti-HIV and anti-cancer effects. Flavonoids belong to a group of natural substances with variable phenolic structures and are found in fruit, vegetables, grains, bark, roots, stems, flowers,

tea, and wine (Middleton, 1998). These natural products were known for their beneficial effects on health long before flavonoids were isolated as the effective compounds.

Pharmocological Evidence of its medicinal properties

The medicinal or curative property of all the fruits and vegetables is due to the phytochemicals present in them. These phytochemicals either prevent the development of a disease by intervening in its genesis or through free radical scavenging or by cytotoxic effect like in case of anti-cancer activity where they kill the mutated cells. The best-described property of almost every group of flavonoids is their capacity to act as antioxidants. Body cells and tissues are continuously threatened by the damage caused by free radicals and reactive oxygen species, which are produced during normal oxygen metabolism or are induced by exogenous damage (de Groot, 1994; Grace, 1994). Flavonoids can prevent injury caused by free radicals in various ways. One way is the direct scavenging of free radicals.

Health Benefits and Curative Properties (Morton, 1987**)**

- The juice of the ripe fruit is said to be diuretic and a remedy for haematuria and urethritis.
- Taken when fasting, it is believed to relieve liver ailments and leprosy.
- Pulverized immature fruits, which are very astringent, are decocted as a dysentery remedy.
- To draw out chiggers and speed healing, the flesh of an acid soursop is applied as a poultice unchanged for 3 days.
- Soursop leaves are regarded throughout the West Indies as having sedative or soporific properties.
- In the Netherlands Antilles, the leaves are put into one's pillowslip or strewn on the bed to promote a good night's sleep. An infusion of the leaves is commonly taken internally for the same purpose.
- It is taken as an analgesic and antispasmodic in Esmeraldas Province, Ecuador.
- In Africa, it is given to children with fever and they are also bathed lightly with it.
- A decoction of the young shoots or leaves is regarded in the West Indies as a remedy for gall bladder trouble, as well as coughs, catarrh, diarrhea, dysentery and indigestion; is said to "cool the blood," and to be able to stop vomiting and aid delivery in childbirth.
- The decoction is also employed in wet compresses on inflammations and swollen feet.
- The chewed leaves, mixed with saliva, are applied to incisions after surgery, causing proudflesh to disappear without leaving a scar.

- Mashed leaves are used as a poultice to alleviate eczema and other skin afflictions and rheumatism, and the sap of young leaves is put on skin eruptions.
- The roots of the tree are employed as a vermifuge and the root bark as an antidote for poisoning. A tincture of the powdered seeds and bay rum is a strong emetic.
- Soursop flowers are believed to alleviate catarrh.

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20. JAMUN *(Syzygium cumini* Skeels*)*

Jamun, *Syzygium cumini* Skeels, belongs to the family Myrtaceae and genus Eugenia which comprises about 1000 species of evergreen trees and shrubs. Some of the old world Eugenia spp. Are now placed in the genus Syzygium. The original home of jamun is considered to be India (Singh, 1969), while it is also found in Thailand, Philippines, Madagascar and other countries.

Jamun fruits are deep purple to violet in colour and are, therefore, very attractive. The anthocyanin pigment is responsible for the colour. The products made from jamun are jellies, jams squash, beverage, wine vinegar and pickle. Jamun syrup is used for treating diarrhea and diabetics. It is stomach, carminative, carminative and diuretic. Jamun seeds also have many therapeuties and concentrate. Also present are gallic acid and tannin and a trace of oxalic acid. In Goa and the Philippines, jambolans are an important source of wine, somewhat like Port, and the distilled liquors, brandy and "jambava" have also been made from the fermented fruit. Jambolan vinegar, extensively made throughout India, is an attractive, clear purple, with a pleasant aroma and mild flavor.

Nutritional Composition of jamun fruit

Constituent	**Quantity / 100 g**	**Constituent**	**Quantity /100g**
Moisture	83.7-85.8 g	Sodium	26.2 mg
Carbohydrates	14.0 g	Potassium	55 mg
Proteins	0.7-0.129 g	Sulphur	13 mg
Fats	0.15-0.3 g	Vitamin A	80 I.U.
Minerals	0.32-0.4g	Riboflavin	0.009-0.01 mg
Crude Fibre	0.3-0.9 g	Thiamine	0.008-0.03 mg
Calcium	8.3-15 mg	Niacin	0.2-0.29 mg
Magnesium	35 mg	Vitamin C	5.7-18 mg
Phosphorus	15-16.2 mg	Choline	7 mg
Iron	1.2-1.62 mg	Folic Acid	3 mcg

(Morton, 1987)

Phytochemicals

Jamun fruit is rich in anthocyanins and tannin. It also contain the enzymes esterase and galloyl carboxylase which are presumed to be active in the biosynthesis of the tannins. The seeds are claimed by some to contain an alkaloid, jambosine, and a glycoside, jambolin or antimellin, which halts the diastatic conversion of starch into sugar. The seed extract has lowered blood pressure by 34.6% and this action is attributed to the ellagic acid content. This and 34 other polyphenols in the seeds and bark have been isolated and identified by Bhatia and Bajaj (1975).

Seeds of *E. jambolana* contain glycosides, a trace of pale yellow essential oil, fat,resin, albumin, chlorophyll2, an alkaloid- jambosine3, gallic acid, ellagic acid, corilagin and related tannin,3,6-hexahydroxydiphenoylglucose and its isomer 4,6-hexahydroxydiphenoylglucose, 1-galloylglucose, 3-galloylglucose, quercetin and elements such as zinc, chromium, vanadium, potassium and sodium. Unsaponifiable matter of seed fat contains β-sitoterol . Various extracts of fruit and seeds of *Syzygium cumini* were found to have antidiabetic, antiinflammatory, hepatoprotective, antihyperlipidemic, diuretic and antibacterial activities. These properties of *Syzygium cumini* seed have been attributed to its saponins, tannins and flavonoids (Bhatia and Bajaj, 1975; Chopra et al, 1956; Indian Medicinal Plants, 1980; Modi et al, 2010). Kumar et al.,(2009) identified a total of 13 and 42 compounds in the leaves and seeds respectively. The main compounds in the leaf extract were heptacosane, nonacosane, octacosane, tricontane, octadecane and in the seed extract, 4-(2-2-dimethyl-6-6-methylenecyclohexyl) butanol, decahydro-8a-ethyl-1,1,4a,6- tetramethylnaphalene, octadecane, 1-chlorooctadecane and tetratetracontane were identified. The major compound in the leaves was octadecane and in the seed 1-chlorooctadecane.

Pharmacological Evidence for its medicinal properties

Syzygium cumini is a tropical aromatic tree and confined to India including Andaman Islands, Bangladesh, Burma and Sri Lanka. Most of the plant parts are used in traditional system of medicine in these countries; its bark is good for sore throat, bronchitis, asthma, thirst, dysentery, blood impurities and to cure ulcers. The fruits can remove bad breath, act as liver tonic, enrich blood and strengthens teeth and gums (Kirtikar and Basu, 1975 ; Priyavtra and Mehta, 1969). The leaves strengthen teeth and gums. The seeds received considerable attention in folk medicine, Ayurveda and Unani traditional system of medicine, as it is antidiabetic (Zafar, 1994; Satyavati and Gupta, 1973; Shukla et al. 2000). The seeds are used to cure diabetes, diarrhoea, dysentery and blood pressure (Chorpa et al., 1956; Lal and Chandhuri, 1968). The powdered plant parts are used to lower blood glucose (level in diabetic patients and in experimentally induced diabetic animals (Ravi et al, 2004a; Srivastava, 1953; Lewis et al., 1956). The seed kernels have anti-diabetic property (Ravi et al, 2004b). The health benefits and curative properties of fruits rich in flavaoids and various kinds of alkaloids has been proved to be brought about by their antioxidant and cytotoxic property (Lampe,1997).

Medicinal Uses of Jamun

The jambolan has received far more recognition in folk medicine and in the pharmaceutical trade than in any other field. Medicinally, the fruit is stated to be astringent, stomachic, carminative, antiscorbutic and diuretic. Cooked to a thick jam, it is eaten to allay acute diarrhea. The juice of the ripe fruit, or a decoction of the fruit, or jambolan vinegar, may be administered in India in cases of enlargement of the spleen, chronic diarrhea and urine retention. Water-diluted juice is used as a gargle for sore throat and as a lotion for ringworm of the scalp.

The leaves, stems, flowerbuds, opened blossoms, and bark have some antibiotic activity. A decoction of the bark is taken internally for dyspepsia, dysentery, and diarrhea and also serves as an enema. The root bark is similarly employed. Bark decoctions are taken in cases of asthma and bronchitis and are gargled or used as mouthwash for the astringent effect on mouth ulcerations, spongy gums, and stomatitis. Ashes of the bark, mixed with water, are spread over local inflammations, or, blended with oil, applied to bums.

Health Benefits and Curative Properties (http://hubpages.com/hub/Medicinal-uses-of-Black-berryBlack-plum-Syzygium-cumini-)

1. The extracts of the bark, seeds and leaves are used for the treatment of diabetes.

2. The leaves have antibacterial properties and used for strenghthening teeths and gums.

3. Oral administration of dried alcohalic extracts of the seeds to diabetic patients was found to reduce the level of blood sugar and glycosuria in trials conducted at CDRI, Lucknow

4. The bark of black berry tree is astringent, digestive, diuretic, anthelmintic and is considered useful for throat problems

5. A decoction of the bark and powdered seeds is believed to be very usefil in the treatment of diarrhea, dysentery and dyspepsia

6. The antibiotic activity of black berry extract has been widely studied and found useful against a number of microbial agents.

7.The fruit is also considered to be stomachic, carminative, antiscorbutic and diuretic.

8. Vinegar made from black berry fruit is administered in cases of enlargement of spleen, chronic diarrhoea and urine retention

9. For ringworm treatment, water diluted juice is used as lotion

10. A decoction of bark is used in cases of asthma and bronchitis and are gargled or used as mouthwash for the astringent effect on mouth ulcerations, spongy gums, and stomatitis.

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21. Tamarind (*Tamarindus indicus*, L)

Tamarind pulp is an important condiment as a sour ingredient in the Indian cookery. Pulp has an excellent keeping quality. Timber is used for making agricultural implements. The wood yields excellent charcoal and is used for making gunpowder. Starch is obtained from seeds and is used in the textile industry. Seeds can be fed to animal after roasting and removing the outer skin. Seed is also a good source of tanning. Oil is obtained from seeds and is used in paints and varnishes. Leaves and flowers are also edible. It is rich in medicinal properties. Fruits is considered as digestive, carminative and laxative. With the addition of water and sugar, tamarind yields a cool drink which is quite popular in Latin America.

Food Value Per 100 g of Edible Portion

Constituents	Quantity		
	Pulp (ripe) *	*Leaves (young)*	*Flowers*
Calories	115		
Moisture	28.2-52 g	70.5 g	80 g
Protein	3.10 g	5.8 g	0.45 g
Fat	0.1 g	2.1 g	1.54 g
Fiber	5.6 g	1.9 g	1.5 g
Carbohydrates	67.4 g	18.2 g	
Invert Sugars	30-41 g		
(70% glucose; 30% fructose)			
Ash	2.9 g	1.5 g	0.72 g
Calcium	35-170 mg	101 mg	35.5 mg
Magnesium		71 mg	
Phosphorus	54-110 mg	140 mg	45.6 mg

Iron	1.3-10.9 mg	5.2 mg	1.5 mg
Copper		2.09 mg	
Chlorine		94 mg	
Sulfur		63 mg	
Sodium	24 mg		
Potassium	375 mg		
Vitamin A	15 I.U.	250 mcg	0.31 mg
Thiamine	0.16 mg	0.24 mg	0.072 mg
Riboflavin	0.07 mg	0.17 mg	0.148 mg
Niacin	0.6-0.7 mg	4.1 mg	1.14 mg
Ascorbic Acid	0.7-3.0 mg	3.0 mg	13.8 mg
Oxalic Acid		196 mg	
Tartaric Acid	8-23.8 mg		
Oxalic Acid	trace only		

(Morton, 1987)

Phytochemicals

Tamarind is a rich source of tartaric acid. Tartaric acid is responsible for the tangy flavor in tamarind; however, it is also a potent antioxidant. . Tamarind pod is rich in several volatile phytochemicals. Some of the phytochemicals present in tamarind are limonene, geraniol, safrole, cinnamic acid, ethyl cinnamate, methyl salicylate, pyrazine and alkylthiazoles; each of them distinct properties which benefit the health in one way or the other. Tamarind is also a rich source of several minerals including copper, calcium, selenium, magnesium, potassium, iron as well as zinc. Seeds contain approximately 63% starch, 14-18% albuminoids, and 4.5-6.5% of a semi-drying oil. (http://www.wellsphere.com/healthy-living-article/health-benefits-of-tamarind/1406344).

The leaves and roots contain the glycosides: vitexin, isovitexin, orientin and isoorientin. The bark yields the alkaloid, hordenine.(Morton, 1987).

Pharmacological Evidence

Phytochemical studies revealed the presence of tannins, saponins, sesquiterpenes, alkaloids and phlobatamins and other extracts active against both gram positive and gram negative bacteria, at temperatures of 4–30 °C (39–86 °F). Studies on the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of the extracts on the test organisms showed that the lowest MIC and the MBC were demonstrated against *Salmonella paratyphi*, *Bacillus subtilis* and *Salmonella typhi* and the highest MIC and MBC was exhibited against *Staphylococcus aureus* (Doughari, 2006).

Pharmacological investigations on *T. indica* extracts reported them to have antibacterial, antifungal (Pousset, 1989), hypoglycaemic, cholesterolemic (Kanzada *et al.,* 2008), cytotoxic (Kobayashi *et al.,*1996), anti-inflammatory (Kanzada e al, 2008), gastrointestinal (Coutino-Rodriguez *et al.,* 2001), hypolipomic and antioxidant activities (Ferrara, 2005). The phytochemical examination of the methanolic extract of the leaves of *T. indica* afforded two triterpenes i.e., lupanone and lupeol. Both compounds (metabolites) have been isolated for the first time from *T. indica* (Shehla Imam *et al.,* 2007).

Edema, hemorrhage and myotoxic effects including lethality, induced by venom were neutralized significantly when different doses of the tamarind seed extract were preincubated with venom before the assays. On the other hand, animals that received extract 10 min after the injection of venom were protected from venom induced toxicity. Tamarind seed extract inhibited the PLA_2, protease, hyaluronidase, L-amino acid oxidase and 5′-nucleotidase enzyme activities of venom in a dose-dependent manner. (Ushanandini et al., 2006).

Health Benefits and Curative Properties (Ushanandini et al, 2006; http://www.kingtutshop.com/Egyptian-Herb/Tamarind.htm ; http://www.online-family-doctor.com/fruits/tamarind.html;)

Medicinal uses of the tamarind are uncountable. Tamarind preparations are universally recognized as refrigerants in fevers and as laxatives and carminatives. Alone, or in combination with lime juice, honey, milk, dates, spices or camphor, the pulp is considered effective as a digestive, even for elephants, and as a remedy for biliousness and bile disorders, and as an antiscorbutic. In native practice, the pulp is applied on inflammations, is used in a gargle for sore throat and, mixed with salt, as a liniment for rheumatism. It is, further, administered to alleviate sunstroke, *Datura* poisoning, and alcoholic intoxication.

Tamarind leaves and flowers, dried or boiled, are used as poultices for swollen joints, sprains and boils. Lotions and extracts made from them are used in treating conjunctivitis, as antiseptics, as vermifuges, treatments for dysentery, jaundice, erysipelas

and hemorrhoids and various other ailments. The bark of the tree is regarded as an effective astringent, tonic and febrifuge. Fried with salt and pulverized to an ash, it is given as a remedy for indigestion and colic. A decoction is used in cases of gingivitis and asthma and eye inflammations; and lotions and poultices made from the bark are applied on open sores and caterpillar rashes. The powdered seeds are made into a paste for drawing boils and, with or without cumin seeds and palm sugar, are prescribed for chronic diarrhea and dysentery. The seedcoat, too, is astringent, and it, also, is specified for the latter disorders. An infusion of the roots is believed to have curative value in chest complaints and is an ingredient in prescriptions for leprosy. The leaves are some times used in subacid infusions, and a decoction is said to destroy worms in children, and is also useful for jaundice, and externally as a wash for sore eyes and ulcers. The pulp, leaves, and the bark also have medical applications. For example, in the Philippines, the leaves have been traditionally used in herbal tea for reducing malaria fever.Tamarind is acidic and excites the bile and other juices in the body. Tamarind is also a blood purifier. folk medicine uses Tamarind leaves for sprains and swelling [Morton, 1987).

In animal studies, tamarind has been found to lower serum cholesterol and blood sugar levels. Due to a lack of available human clinical trials, there is insufficient evidence to recommend tamarind for the treatment of hypercholesterolemia (high cholesterol) or diabetes.) Excess consumption has been noted as a traditional laxative. (http://www.healthline.com/natstandardcontent/tamarind).

Other medicinal uses include: Anthelminthic (expels worms), antimicrobial, antiseptic, antiviral, asthma, astringent, bacterial skin infections (erysipelas), boils, chest pain, cholesterol metabolism disorders, colds, colic, conjunctivitis (pink eye), constipation (chronic or acute), diabetes, diarrhea (chronic), dry eyes, dysentery (severe diarrhea), eye inflammation, fever, food preservative, food uses (coloring), gallbladder disorders, gastrointestinal disorders, gingivitis, hemorrhoids, indigestion, insecticide, jaundice, keratitis (inflammation of the cornea), leprosy, liver disorders, nausea and vomiting (pregnancy-related), paralysis, poisoning (Datura plant), rash, rheumatism, saliva production, skin disinfectant/sterilization, sore throat, sores, sprains, sunscreen, sunstroke, swelling (joints), urinary stones, wound healing (corneal epithelium) (Source : http://www.healthline.com/natstandardcontent/tamarind.)

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22. AONLA (*Phyllanthus emblica,* L (*syn.) Emblica officinalis* Gaertn)

The aonla is one of the most important minor fruits and a crop of commercial significance. Aonla is said to be indigenous to tropical south-eastern Asia, particularly in central and southern India (Firminger, 1947). The genus comprises of about 350 species. Aonla is one of the richest sources of natural ascorbic acid which is protected by high polyphenols content during storage and processing.

Uses

The fruit is widely used in ayurvedic preparation due to its pharmacological properties. The fruits are made into preserve (murabba), sauce, candy, dried chips, etc. Aonla is a good liver tonic. Fruits are pickled and made into, jelly, toffee, etc. bark and leaves are used for tanning and wood is used for preparing hookah.

Amalaki/ Amla (Indian Gooseberry) is also known as Dhatri (the nurse) in sanskrit due to excellent healing properties. It is considered as the **strongest rejuvenator in Ayurveda**. The fruit has a high content of vitamin C, even 20 times as much as oranges. It has excellent rejuvenating power and is used in plenty of ayurvedic preparations. It has been used in ayurvedic medications for curing diseases **like** peptic ulcer, anorexia, hyperacidity, anaemia **etc.**

Nutritional Composition of aonla

Component	**Quantity**	**Component**	**Quantity**
Moisture	81.20 g/100 g	Tannins	4.30 mg/100 g
TSS	12.50 g/100 g	Calcium	0.05 mg/100g
Reducing sugars	3.43 g/100 g	Pectin	2.10 mg/100 g
Total sugars	4.80 g/100 g	Ascorbic acid	600 mg/100 g
Acidity	2.23 g/100 g	Protein	0.5 mg/100 g
Fat	0.10 g/100 g	Phosphorous	0.02 mg/100 g
Carbohydrates	14.0 g/100 g	Vitamin-B	30 mg /100 g
Fibre	3.40 g/100 g		

(Bose and Mitra.,1990)

Phytochemicals

The fruits of *Emblica officinalis* are rich in tannins. The fruits have 28% of the total tannins distributed in the whole plant. The fruit contains two hydrolysable tannins Emblicanin A and B, which have antioxidant properties, one on hydrolysis gives gallic acid, ellagic acid and glucose wherein the other gives ellagic acid and glucose. The fruit also contains Phyllemblin (Anon,1998; Ghosal, 1996 ; Anon, 1988). The fruits, leaves and bark are rich in tannins. The root contains ellagic acid and lupeol and bark contains leucodelphinidin. The seeds yield a fixed oil (16%) which is brownish-yellow in colour. It has the following fatty acids: linolenic (8.8%), linoleic (44.0%), oleic (28.4%), stearic (2.15%), palmitic (3.0%) and myristic (1.0%)(Thakur et al.,1989).

Aonla is a good source of phytochemicals, including flavonoids, tannins, polyphenols, ellagic acid, quercetin, gallic acid and kaempferol. They are best known for their high vitamin C content also. It is reported that a 100-gram serving (3.5 ounces) contains 445 mg, 463 mg, 625 mg, 700 mg, 930 mg, 1,100 mg or 1,700 mg respectively of these phytochemicals. When the fruit is dehydrated, the vitamin C content is even higher, with tested levels ranging from 2,428 mg to 3,470 mg (Andersen, 2008). In addition to this, potent antioxidant, several active tannoid principles (Emblicannin A, Emblicannin B, Punigluconin and Pedunculagin) have been identified which appear to account for its health benefits (Rao et al.,1985; Rastogi, 1993). Meena et al., (2010) reported presence of Alkaloids, Flavones, Tannins and Sugar in aonla. Krishnaveni and Mirunalini (2010) further reported that the plant also contains other phenolic compounds like tannins, phyllembelic acid, phyllembelin, rutin, curcum-inoids, and emblicol which have several curative properties.

Pharmacological Evidence for its medicinal properties

Foodstuffs possess two major functions. That is, the primary function is nutritional feature (life support), and the secondary function is gustational feature (taste, flavor, and texture). Recently, antioxidant potency has been receiving much attention as one of the tertiary function of foodstuffs. The results of Niwano et al., (2011) indicated that the $O_2^{\cdot-}$-scavenging activity was apparently reflected by the polyphenols content. According to them, among all the fruits amla fruit, pomegranate peel, mango kernel and *Syzygium* (Jamun) had the highest free radical scavenging capacity.

The aonla fruit is used either alone or in combination with other plants to treat many ailments such as common cold and fever; as a diuretic, laxative, liver tonic, refrigerant, stomachic, restorative, alterative, antipyretic, anti-inflammatory, hair tonic; to prevent peptic ulcer and dyspepsia, and as a digestive (Baliga and Dsouza, 2011). Preclinical studies have shown that amla possesses antipyretic, analgesic, antitussive, antiatherogenic, adaptogenic, cardioprotective, gastroprotective, antianemia, antihypercholesterolemia, wound healing, antidiarrheal, antiatherosclerotic, hepatoprotective, nephroprotective, and neuroprotective properties. In addition, experimental studies have shown that aonla and some of its phytochemicals such as gallic acid, ellagic acid, pyrogallol, some norsesquiterpenoids, corilagin, geraniin,

elaeocarpusin, and prodelphinidins B1 and B2 also possess antineoplastic effects. Aonla is also reported to possess radiomodulatory, chemomodulatory, chemopreventive effects, free radical scavenging, antioxidant, anti-inflammatory, antimutagenic and immunomodulatory activities, properties that are efficacious in the treatment and prevention of cancer.(Baliga and Dsouza, 2011). Excerpts from some pharmacological studies are listed below.

A study by Xiang et al.,, (2011) revealed that , 1,2,4,6-tetra-O-galloyl-β-d-glucose (1246TGG), a polyphenolic compound isolated from traditional Chinese medicine *Phyllanthus emblica L*. (Amla) , was found to inhibit *Herpes simplex* virus type 1 (HSV-1) and type 2 (HSV-2) infection at different magnitudes of activity in vitro.
Further studies revealed that 1246TGG directly inactivated HSV-1 particles, leading to the failure of early infection, including viral attachment and penetration. 1246TGG also suppressed the intracellular growth of HSV-1 within a long period post-infection (from 0 h p.i. to 12 h p.i.), while it might exert an antiviral effect mainly before 3 h p.i. It inhibited HSV-1 E and L gene expressions as well as viral DNA replication but did not affect the RNA synthesis of IE gene. Also, in the presence of 1246TGG, the synthesis of viral protein was reduced. Taken together, it was suggested that 1246TGG might exert anti-HSV activity both by inactivating extracellular viral particles and by inhibiting viral biosynthesis in host cells.

Experimental studies conducted earlier have proved that *Phyllanthus emblica* (Pe), *Plumbago zeylanica* (Pz) and *Cyperus rotundus* (Cr), plants from the medohara group of Ayurveda possess antiatherosclerotic activity. As inflammation is also one of the pathophysiological factors, it was of interest to Dang et al., (2010) to evaluate whether these drugs exhibit any antiinflammatory activity. Two models of acute inflammation, namely carrageenan induced rat paw edema and acetic acid induced peritonitis in mice were used. In the model of carrageenan induced paw edema Pe, Pz and Cr showed a trend to reduce the edema while the combination of Pe + Pz (PI: 20.64%) showed results comparable to aspirin (23.74%). Whereas in a model of acetic acid induced peritonitis, all the plant drugs i.e. Pe, Pz, Cr and a combination of Pe + Pz showed a significant decrease in the protein content of the peritoneal exudates compared with the disease control group, however, only Pe + Pz exhibited activity comparable to aspirin (Dang et al.,, 2010).

Aonla, improves body metabolism and is a rich source of vitamin C. Ascorbic acid is one of the important water soluble vitamins. It is essential for collagen, carnitine and neurotransmitters biosynthesis (Naidu, 2003). It is particularly good for bones, liver, teeth, and heart. It increases the red blood cells and promotes tissue growth. Apart from improving eyesight, it relives stomach and colon inflammation, and regulates the blood sugar levels.

Ascorbic acid has several functions like, it constitutes the principal protein of skin, bones, teeth, cartilage, tendons, blood vessels, heart valves, inter vertebral discs,

cornea and eye lens. Ascorbic acid is essential to maintain the enzyme prolyl and lysyl, In addition, ascorbic acid catalyzes other enzymatic reactions involving amidation necessary for maximal activity of hormones oxytocin, vasopressin, cholecystokinin and alpha-melanotripin (Cameron and Pauling, 1973). In ascorbic acid deficiency, this reaction becomes slowed down thus, resulting in an accumulationof cholesterol in liver, hypercholesterolemia, formation of cholesterol gall stones etc (Ginter et al., 1982).

It is also a good laxative, astringent, an anti-pyretic and good tonic for brain and nerves. Because of its tremendous medicinal value, it is useful in treating acidity, anaemia, anorexia, heart diseases, jaundice, haemorages and troubles pertaining to genital and urinary tracts. It is a di-uretic and provides relief when used as a medication for dyspepsia and other metabolic disorders.

Cameron and Pauling (1973) believed that ascorbic acid combats cancer by promoting collagen synthesis and thus prevents tumors from invading other tissues. However, researchers now believe that ascorbic acid prevents cancer by neutralizing free radicals before they can damage DNA and initiate tumor growth and or may act as a pro-oxidant helping body's own free radicals to destroy tumors in their early stages (Block, 1991; Frei, 1994; Uddin and Ahmad, 1995).

Indian gooseberry has undergone preliminary research, demonstrating in vitro antiviral and antimicrobial properties (Saeed and Tariq, 2007). There is preliminary evidence in vitro that its extracts induce apoptosis and modify gene expression in osteoclasts involved in rheumatoid arthritis and osteoporosis.(Penolazzi, 2008).

Experimental preparations of leaves, bark or fruit have shown potential efficacy against laboratory models of disease, such as for inflammation, cancer, age-related renal disease, and diabetes.(Jayshri and Jolly, 1993; Jamwal et al., 1959 ; Thakur and Mandal, 1984).

A human pilot study demonstrated reduction of blood cholesterol levels in both normal and hypercholesterolemic men (Ganju et al., 2003; Jacob et al., 1988). Another recent study with alloxan-induced diabetic rats given an aqueous amla fruit extract has shown significant decrease of the blood glucose as well as triglyceridemic levels and an improvement of the liver function caused by a normalization of the liver-specific enzyme alanine transaminase (ALT) activity (Rao et al., 2005 ; Qureshi et al., 2009).

Although fruits are reputed to contain high amounts of ascorbic acid (vitamin C), 445 mg/100g, the specific contents are disputed and the overall antioxidant strength of amla may derive instead from its high density of tannins and other polyphenols (Shankar, 1969 ; Tarwadi and Agte, 2007 ; Rehman et al., 2007).

Medicinal uses and Curative properties

Indian gooseberry has been used as a valuable ingredient of various medicines in India and

Middle East from time immemorial.

Aperient

The green fruits are made into pickles and preserves to stimulate the appetite.

Antibacterial, antifungal, antiviral

Medical studies conducted on Amla fruit suggest that it has antiviral properties (Udupa,1985) and also functions as an antibacterial and anti-fungal agent (Treadway, 1994).

Antioxidant

The use of amla as an antioxidant has been examined by a number of authors [Chaudhuri et al.,, 2007 [37]]. Experiments conducted at the Niwa Institute of Immunology in Japan have shown Amla to be a potent scavenger of free radicals. The studies showed that Amla preparations contained high levels of the free-radical scavenger, superoxide dimutase (SOD), in the experimental subjects (Treadway,1994).

Aphrodisiac

Amla is believed to increase *ojas*, and is considered to be one of the strongest rejuvenative herbs in Ayurvedic medicine. It is the primary ingredient used in one of the renowned Ayurvedic herbal formulae, called *Chayavanprasha* which has great respect as a tonic (Watson, 1993). Beside amla, chayavanprasha contains around 30 to 50 other herbs depending on where it is prepared.

Boils and spots

The pericarp of the fruit is often used in decoctions along with other ingredients and also applied externally on boils with cow ghee to promote suppuration (Jayaweera, 1980).

Chelating agent

Photoaging of the skin is a complex biologic process affecting various layers of the skin with major changes seen in the connective tissue within the dermis. Emblica was shown to reduce UV-induced erythema and had excellent free-radical quenching ability, chelating ability to iron and copper as well as MMP-1 and MMP-3 inhibitory activity (Chaudhuri, et al., 2003).

Constipation

The fruit is occasionally pickled or preserved in sugar. While dry it is said to be gently laxative (Drury, 1893), according to some sources the fresh fruit is also laxative (Nadkarni & Nadkarni,1999). The fresh ripe fruits are used extensively in India as a laxative, one or two fruits being sufficient for a dose.

They have been exported to Europe, preserved in sugar, and are valued as a pleasant laxative for children and made into a confection consisting of the pulp of the de-seeded fruit (. Fruits along with those of *Terminalia bellirica* and *T. chebula* are the constituents of "Triphala" which are used as a laxative (Dey, 1896 ; Thakur, 1989).

Dental problems

The roots of *Emblica officinalis* (10 g) are ground and taken twice daily for one day only after taking food. Alternatively, the leaves of *Emblica officinalis* are squeezed and the juice extracted. This juice is put in the ear (a few drops) to find relief from toothache. A final alternative is to grind the node of a *Emblica officinalis* and mix it with water. After vigorous stirring it is filtered through a cloth. This water is put drop by drop in the right ear if the teeth on the left hand side are in pain and *vice versa*. The remedy is continue for three days.

Diabetes

The fruits are used in the treatment of diabetes (Drury, 1873) and in other references an infusion of the seeds are also used (Nadkarni & Nadkarni, 1999). Decoctions of the leaves and seeds are used in the treatment of diabetes mellitus (Treadway, 1994).

Diarrhoea

It is used medicinally for the treatment of diarrhoea. As a fruit decoction it is mixed with sour milk and given in cases of dysentery (Drury,1873 **)**. The bark partakes of the astringency of the fruit. A decoction and evaporation of the root solution produces an astringent extract equal to catechu (Nadkarni & Nadkarni, 1999). An infusion of the leaves with fenugreek seed is given for chronic diarrhoea (Jayaweera, 1980).

Diuretic

The fresh fruit is diuretic (Nadkarni & Nadkarni, 1980). A paste of the fruit alone or in combination with *Nelumbium speciosum* (the Egyptian Lotus), Saffron [author's note: more likely to be *Curcuma longa* (Indian saffron) than *Crocus sativus* (saffron)] and rose water is a useful application over the pubic region in irritability of the bladder, in retention of urine. A sherbat prepared from the fresh fruit with (or without) raisins and honey is a favoured cooling drink which has a diuretic effect. A decoction of the fruit

with stems of *Tinospora cordifolia* is a well-known remedy for various urinary diseases (Jayaweera, 1980).

Fevers

Malays use a decoction of its leaves to treat fever (Burkill, 1966). The seeds are given internally as a cooling remedy in bilious afflictions and nausea, and in infusion it makes a good drink in fevers (Drury, 1873; Nadkarni & Nadkarni, 1999). Often after a fever there is a loss of taste and a decoction of the emblic seed, dried grapes and sugar is used for gargling. A decoction of the emblic seed, chitrak root (*Plumbago zeylanica* or Leadwort), chebulic myrobalan and *pipli* (*Piper longum*) is given in fevers and there is also a compound powder composed of equal parts of the emblic seed (*Emblica officinalis*), chitrak root, chebulic myrobalan, pipli and saindhava (rock salt) which may also be used.

Gonorrhoea

The juice of the bark combined with honey and turmuric is a remedy for gonorrhoea (Jayaweera, 1980; Nadkarni&Nadkarni, 1999).

Hair growth

A fixed oil is obtained from the berries that is used to strengthen and promote the growth of hair. The dried fruits have a good effect on hair hygiene and have long been respected as an ingredient of shampoo and hair oil (Thakur et al., 1989). Indian gooseberry is an accepted hair tonic in traditional recipes for enriching hair growth and also pigmentation. The fruit, cut into pieces, is dried, preferably in shade and then boiled in coconut oil, the resulting oil is said to be excellent for preventing hair greying – in Ayurvedic terms, a classic sign of excess *pitta dosha*. The water in which dried amla pieces are soaked overnight is also said to be nourishing to the hair.

Headache

A *paste* of the fruit is a useful application to the forehead in cases of cephalgia (headache). The name "Itrifal" of Unani medicine is the same as "Triphala" in the Ayurvedic system and represents a group of preparations used for the care of all manner of cranial conditions (Thakur et al.,, 1989[41]). The expressed juice of the fruit along with other ingredients is used to cure fits and insanity (Jayaweera, 1980 [36]). In Indonesia, the pulp of the fruit is smeared on the head to dispel headache and dizziness caused by excessive heat (Perry, 1980[43]). Amla is mixed with buttermilk for anointing and "cooling" the head (Treadway, 1994).

Indigestion

Fruit is carminative and stomachic (Nadkarni & Nadkarni, 1999). The tender shoots given in butter-milk cure indigestion and it is known that green fresh leaves combined with curds have similar effect.

Inflammation

P. emblica L. has been used for anti-inflammatory and antipyretic treatments by rural populations in its growing areas (Burkill, 1966).

Mouth ulcers

A decoction of the leaves is used as a chemical-free bactericidal mouthwash (Treadway,1994).

Bark of the root mixed with honey is applied to inflammations of the mouth (Drury, 1873) and a decoction of the leaves is also useful as a mouth wash in the treatment of aphthae. Another remedy suggest root bark rubbed with honey is used in aphthous stomatitis (an inflammation of the mouth) (Nadkarni & Nadkarni, 1999).

Nausea

Amla powder is mixed with red sandalwood (*Pterocarpus santalinum*) and prepared in honey to relieve nausea and vomiting (Treadway, 1994**)**.

Nose bleed

The seed are fried in ghee and ground in *conjee* (the liquid from boiled rice) is applied to the forehead to stop bleeding from the nose.

Perfumery

An essential oil is distilled from the leaves that is used in perfumery.

Pruritis

The seed are burnt, powdered and mixed in oil as a useful application for scabies or itch.

Respiratory problems

The fresh fruit is used in Turkeystan in inflammations of the lungs. The juice or extract of the fruit is mixed with honey and pipit added is given to stop hiccough and also in painful respiration. The expressed juice of the fruit along with other ingredients is used to cure cough, hiccough, asthma and other diseases (Jayaweera, 1980). Dyspnoea (breathing difficulty): The following materials are all ground into a paste - *Emblica officinalis* (10g leaves), *Terminalia chebula* (5 fruits), *Piper nigrum* (9 seeds), one garlic, 25 ml ghee

(made from cow's milk) and a clove. Take the paste orally once daily for seven days to get relief. It is also used for oligopnoea (shallow or infrequent breaths).

Scurvy

Anti-ascorbutic virtues have been attributed to the Aonla fruits.

Skin sores and wounds

The milky juice of the leaves is a good application to sores. Grind the bark of *Emblica officinalis* (10g) into a paste and apply to the cut or wound area once daily for 2 to 3 days. Alternatively, squeeze *Emblica officinalis* leaves and extract the juice to the cut once daily for 3 to 4 days. Healing occurs when the dynamic harmony of the *doshas* is restored (Treadway, 1994).

Skin whitening

Skin lightening agents have been widely used to either lighten and depigment the skin in the Asia, Far East and Middle East countries, whereas in the European market products tend to be employed for age spots and freckles. The effectiveness of a standardized antioxidant fraction of *Phyllanthus emblica* fruits as a skin lightener and also as an antioxidant was proven (Chaudhuri, 2004).

Sore eyes

Infusion of the leaves is applied to sore eyes (Drury, 1873). The dried fruit immersed in water in a new earthen vessel a whole night yields a decoction which is used as a *collyrium* (a medical lotion applied to the eye as an eyewash) in ophthalmia. It may be applied cold or warm (Nadkarni & Nadkarni, 1999). In another treatment an infusion of the seeds is also used as a collyrium and applied with benefit to recent inflammations of the conjunctive and other eye complaints. The exudate collected from incisions made on the fruit is applied externally on inflammation of the eye (Jayaweera, 1980). In Ayurvedic terms it lowers *pitta* without disrupting the other two *doshas* and so amla is frequently used in cataract medicine.

Tonic

The juice of the fresh fruit when mixed with ghee is considered a good restorative tonic. The leaves are used as infusion with fenugreek seeds in chronic dysentery and as a bitter tonic. A powder made from equal quantities of emblic seed and *Withania somnifera* root are given with ghee and honey as a restorative invigorator, especially good for those cold winter days.

Half a drachm each of the emblic seed and gokhru (*Tribulus terrestris*) powdered and mixed with 15 grains of essence of gulancha (*Tinospora cordifolia*) and given early

morning in ghee and sugar is an equally nutrient tonic. These rejuvenation and longevity tonics are known as the "*rasayana*".

Vaginal complaints

A mixture of the fruit juice and sugar is used for the relief of burning in the vagina.

Water purification

In certain districts (Travancore) the natives put the young branches into the wells to impart a pleasant flavour to the water, especially if it be impure from the accumulation of vegetable matter or other causes.

Worms

In Persia the juice of the fruit is used as a vermifuge and it is generally given with honey; the dose is from 1 to 3 drachms (Nadkarni & Nadkarni, 1999).

Miscellaneous

The bark of the tree itself is astringent, and is used for tanning purposes.

A compilation of applications for emblica fruits was carried out by several Ayurvedic writers during the last 25 years. The main indications are:

- Digestive system disorders: dyspepsia, gastritis, hyperacidity, constipation, colic, colitis, hemorrhoids
- Bleeding disorders: bleeding hemorrhoids, hematuria, menorrhagia, bleeding gums, ulcerative colitis
- Metabolic disorders: anemia, diabetes, gout
- Lung disorders: cough, asthma
- Aging disorders: osteoporosis, premature graying of hear, weak vision
- Neurasthenia: fatigue, mental disorders, vertigo, palpitations

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23. CARAMBOLA (*Averrhoa carambola*, L)

The carambola, *Averrhoa carambola* L., is believed to have originated in Ceylon and the Moluccas but it has been cultivated in southeast Asia and Malaysia for many centuries. A curious, attractive fruit of the Oxalidaceae, the carambola, *Averrhoa carambola* L., has traveled sufficiently to have acquired a number of regional names in addition to the popular Spanish appelation which belies its Far Eastern origin. In the Orient, it is usually called *balimbing, belimbing,* or *belimbing manis* ("sweet belimbing"), to distinguish it from the bilimbi or *belimbing asam, A. bilimbi* L. In Ceylon and India, the carambola has the alternate names of *kamaranga, kamruk,* or other variants of the native *kamrakh.*

Food Uses

Fruits are mainly used for dessert purpose . slightly unripe fruits are used for jelly and pickle. Unripe fruit is also used for dying as it contain potassium oxalate. It is a popular substitute for tamarind in cooking.

Other Uses

The acid types of carambola have been used to clean and polish metal, especially brass, as they dissolve tarnish and rust. The juice will also bleach rust stains from white cloth. Unripe fruits are used in place of a conventional mordant in dyeing.

Wood: Carambola wood is white, becoming reddish with age; close-grained, medium-hard. It has been utilized for construction and furniture.

Nutritional Composition of Carambola

Component	**Quantity**	**Component**	**Quantity**
Moisture	91.9 g/100g	Riboflavin	0.03 mg/100 g
Carbohydrates	6.10 g/100 g	Vitamin C	53.1 mg /100 g
Proteins	0.70 g/100g	Niacin	0.38 mg/100 g
Fats	0.10 g/100 g	Tryptophan	3.0 mg/100 g
Fibres	0.80 g/100 g	Methionine	2 mg/ 100g
Minerals	0.40 g/100 g	Lysine	26 mg/ 100 g
Calcium	4.0 mg/100 g	Serine	3.88-2.00 µM/ g
Phosphorus	11 mg/100 g	Glutamic Acid	2.41-1.80 µM/ g

Thiamine	0.038 mg /100 g	Alanine	5.40-1.26 µM/ g
Carotene	0.552 mg/ 100 g		

(Gopalan, et al.,, 1985 & Morton,1987)

Food Uses

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Other Uses

The acid types of carambola have been used to clean and polish metal, especially brass, as they dissolve tarnish and rust. The juice will also bleach rust stains from white cloth. Unripe fruits are used in place of a conventional mordant in dyeing.

Wood: Carambola wood is white, becoming reddish with age; close-grained, medium-hard. It has been utilized for construction and furniture.

Phytochemicals

Carambola or the star fruit as it is called is a natural source of primary and secondary polyphenolic antioxidants. Polyphenols are plant-made phytochemicals called flavonoids. In addition to antioxidants, the star fruit is a great source of Vitamin C, and has Vitamin A, Iron and Potassium as well. It also has plenty of trace minerals to satisfy true *nutritionistas from* non-negligible amounts of calcium, phosphorus, carotene, thiamine, riboflavin niacin, to the amino acids tryptophan, methionine and Lysine (University of Florida – Horticultural Sciences: Carambola: http://edis.ifas.ufl.edu/ MG269). Previous phytochemical investigation led to the isolation of 5-hydroxymethyl-2-furfural,(Jabbar et al.,1995) volatile components, (Macleod, et al., 1990; Frohlich and Schreier, 2006) L-ascorbic acid, (−)epicatechin and gallic acid (Shui, G. and Leong, L.P. 2004) and dihydroabscissic alcohol (Lutz and Winterhalter, 1994). Mia et al., (2007) isolated ***p*-Anisaldehyde and** β-sitosterol from carambola**.** was identified by comparing its H NMR data with published values (Morales et al.,, 2003) and thorough Co- TLC with an authentic sample.

Pharmacological Evidence of its medicinal properties

The study by Mia et al., (2007) revealed that the petroleum ether extract of carambola moderately inhibited the growth of E. coli and S. dysenteriae having the zone of inhibition of 12 mm each. Preliminary phytochemical screening test results that

Averrhoa carambola L. extract contains flavonoid compounds, which is catechin that plays a role in the formation of dental plaque by inhibiting the synthesis of ISG (Insoluble glucan) by Gtase so it can reduce dental plaque formation. The study also suggested that *Averrhoa carambola* L. extracts can be used as antibacterial substances against Streptococcus mutans. (www. alumni.unair.ac.id/kumpulanfile/ 6696832850_ abs.pdf). Ulcers are caused due to an imbalance between mucosal integrity and aggressive factors. For maintenance of the mucosal integrity, different therapeutic agents, including plant extracts, are used to inhibit gastric acid secretion or to stimulate the mucosal defense mechanism by increasing the mucosal production of the surface epithelial cells, or by interfering with mediatorssynthesis (Goyal and Sairam, 2002) .Conclaves et al., (2006) investigated the anti-ulcerogenic potential of the water-alcohol extract of leaves of *Averrhoa carambola* (ACE) and suggested that it has some anti-ulcer activity with different mechanisms of action**.** In phytochemical studies of plants with antiulcer properties, activity due to the presence of triterpenes, flavonoids, and mucilage was observed (Lewis and Hanson, 1991). As ACE contains these constituents, the partial anti-ulcer activity could be due their effects. On the other hand, the mucilage present in ACE could act directly to protect the gastric mucosa, avoiding gastric damage induced by necrotizing agents (Conclaves et al., 2006). The medicinal and therapeutic properties of carambola is could be due to the various useful phytochemicals listed above through their antioxidant property , inhibitorory activity and synergy action on various biological mechanisms reported else where in this book. However, the literature reports that uremic patients develop severe and acute intoxication after eating carambola or drinking its juice, with intractable hiccups, sudden onset of limb numbness, muscle weakness, consciousness disturbance, and seizure (Neta et al., 2003 & Tse et al., 2003) which could be due to depressed heart rate and the myocardial contractile force induced by certain active compounds in carambola fruit (Vasconcelos et al., 2005).

In spite of this therapeutic effort, many cases show a poor outcome which result in death (Neto et al., 1998; Chang et al., 2000 & 2002). A water-soluble neurotoxin was isolated from star fruit (Cecchini et al., 1999). This protein induced convulsion in rats by acting on L-glutamate release, as demonstrated in synaptosomes prepared from the rat cerebral cortex (Neto et al., 1998.).

Health Benefits and Curative Properties

In India, the ripe fruit is administered to halt hemorrhages and to relieve bleeding hemorrhoids; and the dried fruit or the juice may be taken to counteract fevers.
Fruits and its fruit juice are used as antioxidant, astringent, tonic also to treat diarrhoea, vomiting, dysentery, hepatic colic, bleeding piles, relieving thirst and febrile excitement. The leaves are antipruritic, antipyretic and anthelmintic and are also useful in scabies, fractured bones, and various types of poisoning,intermittent fevers and intestinal worms. (Vanconcelos et al., 2005). In Brazilian folk medicine, its fruit, juice or tea prepared from

its leaves, has been used for treating headache, vomiting, cough, insomnia, hypertension, and diabetes (Oliveira et al., 1989; Pio-Correa, 1931; Muir and Lam, 1980; Martha et al., 2000; Padmawinata and Hoyaranda, 1980).

A conserve of the fruit is said to allay biliousness and diarrhea and to relieve a "hangover" from excessive indulgence in alcohol. A salve made of the fruit is employed to relieve eye afflictions. In Brazil, the carambola is recommended as a diuretic in kidney and bladder complaints, and is believed to have a beneficial effect in the treatment of eczema. In *Chinese Materia Medica* it is stated, "Its action is to quench thirst, to increase the salivary secretion, and hence to allay fever."

A decoction of combined fruit and leaves is drunk to overcome vomiting. Leaves are bound on the temples to soothe headache. Crushed leaves and shoots are poulticed on the eruptions of chicken-pox, also on ringworm.

The flowers are given as a vermifuge. In southeast Asia, the flowers are rubbed on the dermatitis caused by lacquer derived from *Rhus verniciflua* Stokes.

Burkill says that a preparation of the inner bark, with sandalwood and *Alyxia sp., is* applied on prickly heat. The roots, with sugar, are considered an antidote for poison. Hydrocyanic acid has been detected in the leaves, stems and roots.

A decoction of the crushed seeds acts as a galactagogue and ernmenagogue and is mildly intoxicating. The powdered seeds serve as a sedative in cases of asthma and colic.

Puerto Rican technologists found the oxalic acid content of ripe carambolas to average 0.5 g per 100 ml of juice, the acid being mostly in the free state. They likened the juice to rhubarb juice and advised that physicians be informed of this because there are individuals who may be adversely affected by ingestion of even small amounts of oxalic acid or oxalates. Other investigators have presumed the oxalic acid in fully ripe carambolas to be precipitated as calcium oxalate or in solution as neutral salts.. Morton, 1987). Star fruit may lower cholesterol levels and add bulk and moisture to feces. A decoction of leaves and roots (prepared separately or in combination) can help cure headaches, ringworm, and chickenpox. The fruit is known to cure hangovers and prickly heat. You can also use the pickled fruit for hangover just take one piece of the pickled fruit, steam in water and serve. The fruit has also been used to treat sore eyes. The star fruit is given to nursing mothers as it is commonly believed to stimulate the flow of milk. The health risk needs further study.(**http://hubpages.com/hub/Health-Benefits-of-Star-Fruit)**

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24. LONGAN (*Dimocarpus longan* Lour)

Longan (*Dimocarpus longan* Lour), belongs to the family, Sapindaceae. The longan is native to southern China, in the provinces of Kwangtung, Kwangsi, Schezwan and Fukien. The longan is less important to the Chinese as an edible fruit, more widely used than the lychee in Oriental medicine. The longan was introduced into India in 1798.

Food Uses

Although longan is mainly used for dessert purpose. It can be dried, frozen or canned. Preserved longans are considered by many as superior to preserved litchi, the flavour being more delicate. Longans are much eaten fresh, out-of-hand, but some have maintained that the fruit is improved by cooking. In China, the majority are canned in sirup or dried. The canned fruits were regularly shipped from Shanghai to the United States in the past. Today, they are exported from Hong Kong and Taiwan.

The dried longan product is black, leathery and smoky in flavor and is mainly used to prepare an infusion drunk for refreshment. A liqueur is made by macerating the longan flesh in alcohol. (Morton, 1987).

Other Uses

Seeds and rind: The seeds, because of their saponin content, are used like soapberries *(Sapindus saponaria* L.) for shampooing the hair. The seeds and the rind are burned for fuel and are part of the payment of the Chinese women who attend to the drying operation.

Wood: While the tree is not often cut for timber, the wood is used for posts, agricultural implements, furniture and construction. The heartwood is red, hard, and takes a fine polish. It is not highly valued for fuel.

Nutritional Composition of Longan fruit

Component	Quantity	Component	Quantity

Moisture	82.4 g /100g	Iron	1.2 mg /100g
Protein	1.0 g /100 g	Vitamin A	28 IU /100 g
Fat	0.1 g /100 g	Ascorbic Acid	6 mg /100 g
Carbohydrates	15.8 g/100g	Calories	61 Kcal/100g
Fiber	0.4 g/100g	Vitamin B	10.04 mg /100 g
Ash	0.7 g/100g	Vitamin B2	0.07 mg /100 g
Calcium	10 mg/100g	Niacin	0.6 mg /100 g
Phosphorus	42 mg /100 g		

(Morton, 1987)

Phytochemicals

The major components identified in Longan fruit are gallic acid, corilagin (an ellagitannin) and ellagic acid (Rangkadilok et al., 2005**).** Chieh Hsieh et al., (2008) reported that the methanol extract of Longan flower when separated by liquid−liquid partition into *n*-hexane, ethyl acetate, *n*-butanol, and water fractions, the ethyl acetate fraction was found to have the highest activity of delaying LDL oxidation. After silica gel column chromatography, the fraction having a superior activity was identified as containing two major compounds, (−)-epicatechin and proanthocyanidin A2.

High-performance liquid chromatography coupled with electrospray ionization mass spectrometry (HPLC-ESI-MS) analysis revealed the phenolics profile of longan (*Dimocarpus longan* Lour.) seed. Gallic acid, ellagic acid, monogalloyl-glucose, monogalloyl-diglucose, digalloyl-diglucose, penta- to heptagalloyl-glucose, ellagic acid-pentose conjugate, galloyl-HHDP (Hexahydroxydiphenoyl)-glucopyranose, pentagalloy-HHDP-glucopyranose, procyanidin A-type dimer, procyanidin B2 and quercetin-3-O-rhamnoside were found to be present in longan seed along with a number of, as yet, unknown compounds. The results illustrated a rich array of phenolic compounds in longan seeds which could be utilized as health-beneficial bioactive compounds (Soong and Barlow , 2005).

Pharmocological Evidence of its medicinal properties

A common denominator in pathogenesis of most chronic diseases is the involvement of oxidative stress, related to the production by all aerobic organisms of reactive oxygen and nitrogen species, including free radicals (Beckman et al., 1998; Ames et al., 1993). In addition to having a role in intra- and extracellular signaling, these reactive molecular species may initiate damaging biochemical reactions (Breviba et al.,,

1997; Halliwell, 1996; Sen and Pakcer , 1996). In response to such damage, a complex antioxidant defense has developed, and dietary antioxidants comprise an important role in this defense (Halliwell, 1999; Carr and Frei, 1999). Protective effects of fruits and vegetables result from the action of lesser-known antioxidant compounds or from a concerted action of the cocktail of antioxidants present in foods. In-viro and in-vivo studies conducted in several fruits and vegetables have proved this hypothesis.

Antiobesity and hypolipidemic effects of polyphenol-rich longan flower water extract (LFWE) were investigated by Hsiung Yang et al., (2010). Body weight, size of epididymal fat, serum triglyceride level and atherogenic index, and hepatic lipids were decreased in HCD rats by drinking 2.5% LFWE which may result from downregulated pancreatic lipase activity, and sterol regulatory element binding protein-1c (SREBP-1c) and fatty acid synthase (FAS) gene expressions, as well as upregulated ($p < 0.05$) LDL receptor (LDLR) and peroxisome proliferator-activated-receptor-alpha (PPAR-α) gene expressions, and also increased fecal triglyceride excretions.

Several epidemiologic studies have shown that chronic inflammation predisposes individuals to various types of cancer. Many cancers arise from sites of infection, chronic irritation, and inflammation. Conversely, an oncogenic change induces an inflammatory microenvironment that promotes the development of tumors. Natural bioactive compounds in dietary plant products including fruits, vegetables, grains, legumes, tea, and wine are claimed to help prevent cancer, degenerative diseases, and chronic and acute inflammation. Modern methods in cell and molecular biology allow us to understand the interactions of different natural bioactive compounds with basic mechanisms of inflammatory response. The molecular pathways of this cancer-related inflammation are now unraveled. Natural bioactive compounds exert anti-inflammatory activity by modulating pro-inflammatory gene expressions have shown promising chemopreventive activity (Min et al., 2009).

Bae et al., (2011) indicated through their studies that MYH treatment (which is a herbal formulation containing longan fruit besides 9 other herbs) has neuroprotective effects that are partially mediated by autophagy enhancement. MYH may be a promising herbal formula for the prevention and treatment of neurodegenerative diseases, especially Parkinson's Disease.

Zhong et al., (2010) investigated the effects of polysaccharides from longan pulp with ultrasonic extraction (UELP) on the radicals scavenging, immunity-modulatory and antitumor activities in S180 tumor mice models. UELP showed excellent scavenging activity on the hydroxyl radicals and a,a-diphenyl-1-picrylhydrazyl (DPPH) radicals, and obtained the almost complete scavenging effect. UELP with medium-dose (200mg/kg) and low-dose (100mg/kg) had potent immune-modulatory effects in S180 tumor mice model and exhibited significant effect on delayed-type hypersensitivity (DTH) response, macrophage phagocytosis and ConA-stimulated splenocyte proliferation as compared with model control treatment. The results still showed that UELP had great antitumor

effects, and maximum inhibition rate was obtained at medium-dose and low-dose (200 and 100mg/kg).

Zheng et al., (2010) studied in mice the antifatigue effects of the hot-water extract of longan (*Dimocarpus longan* Lour.) seeds. Longan seed polysaccharides were administered at doses of 50, 100, 200 and 400 mg/kg and antifatigue activity was evaluated using a swimming test, along with the determination of serum urea nitrogen, hepatic glycogen and blood lactic acid content. The results show that longan seed polysaccharides, in doses ranging from 50 to 100 mg/kg, extended swimming time, increased hepatic glycogen, reduced blood urea nitrogen and decreased blood lactic acid in the mice. Therefore longan seed polysaccharides may have potential as an antifatigue agent.

The studies of Chung et al., (2010) indicate that Longan Seed Polyphenol (LSP) is a potential and novel chemoprevention and treatment agent for colorectal cancer. LSP inhibited the proliferation by blocking cell cycle progression during the DNA synthesis phase and inducing apoptotic death. Western blotting indicated that LSP blocks the S phase, reducing the expression of cyclin A and cyclin D1. Hsu et al., (2010) also indicated similar results using Longan flower extract (LFE). Longan flower extract (LFE) has been shown to exhibit free radical scavenging ability and anti-inflammatory effects. LFE (25-400 microg/ml) could inhibit proliferation in a dose- and time-dependent manner. The cell cycle of both LFE-treated cell lines showed obvious S phase block. Western blotting further showed the S phase block in these two cell lines was mainly due to cyclin E accumulation and cyclin A decrease. LFE treatment increased rhodamine 123-negative cells and DNA fragmentation in Colo 320DM cells but not in SW480 cells. Increased levels of the apoptosis activation protein, caspase 3, were also found in Colo 320DM cells. The activation of caspase 3 in LFE-treated SW480 cells was not significant. The caspase 3 activation in Colo 320DM cells by LFE was mediated by the suppression of Bcl-2 protein levels. LFE treatment could inhibit the proliferation and malignancy of colorectal cancer cell lines and was associated with S phase block of the cell cycle. An apoptotic mechanism induced by LFE involving a loss of mitochondrial membrane potential and caspase 3 activation was found in Colo 320DM cells but not in SW480 cells. The results of this study indicate that LFE has potential to be developed as a novel functional food or chemopreventive agent for colorectal cancer.

Health Benefits and Curative Properties

The flesh of the fruit is administered as a stomachic, febrifuge and vermifuge, and is regarded as an antidote for poison. A decoction of the dried flesh is taken as a tonic and treatment for insomnia and neurasthenic neurosis.

The leaves of Longan contain quercetin and quercitrin. Burkill says that the dried flowers are exported to Malaysia for medicinal purposes. The seeds are administered to counteract heavy sweating and the pulverized kernel, which contains saponin, tannin and fat, serves as a styptic (Morton, 1987). There are several other curative properties popular among the folklore in different countries where Longan is grown.

- Longan is said to be used as remedy for stomach ache, insomnia, amnesia, and dropsy.

- The fruit is said to invigorate the heart and spleen, nourish the blood and have a calming effect on the nervous system. A spoonful of longan tonic made of equal quantities of longan flesh and sugar simmered in water till it is reduced to a syrup consistency is recommended twice a day.

- A decoction of the dried flesh is taken as a tonic and treatment for insomnia and neurasthenic neurosis.

- In Vietnam, the "eye" of the longan seed is pressed against snakebite in the belief that it will absorb the venom.

- The seeds are administered to counteract heavy sweating, the pulverized kernel, which contains saponin, tannin and fat, serves as a styptic (substance that draws together or constricts body tissues and is effective in stopping the flow of blood or other secretions). **http://hubpages.com/hub/Health-Benefits-of-Longan**

In Traditional Chinese Medicine (TCM), these fruits are considered warm, sweet and astringent. Many parts of the plant are used medicinally including the fruit itself, which when dried, relieves anxiety. The leaves are said to cool the system, the flowers an aid the kidneys, as are the seeds. The roots are used to treat diabetics and to treat gonorrhea. Also the fruit, with the exterior shell left on, is used in a tea known as *san po tai* made with rock sugar and tea leaves added.

The fruit, as a traditional Chinese medicine, is used for cardiac palpitations and books recommend an ounce of it steamed with a teaspoon of pickled Chinese dates be consumed once a day. For weakness, and for those with lack of strength during pregnancy, the same amount of fruit is recommended but mixed with two ounces of crystallized brown sugar, one ounce of red dates, and a teaspoon of fresh ginger; these are to be steamed together and this amount eaten once a day.

The longan has other roles in Chinese medicine. One touted, is for those with premature gray hair. They should drink an ounce of longan wine, a blood tonic, every morning and every evening. Longan wine blood tonic also enriches the blood. There is a non-alcoholic longan tonic that simmers the same amount of fruit with an equal amount of sugar until very thick. It is taken twice daily, as well.

Dried longan fruit that was soaked in hot water rather than sun-dried, is used for loss of appetite, ulcers that do not heal, wounds and bleeding, ringworm or other scalp itches, even for relief of armpit and body odor. For that last item, the recipe calls for half an ounce of the pit ground then mixed with two teaspoons of black pepper to make an poultice. This is put directly on the odoriferous body part, amount of time it needs to stay there not mentioned.

http://www.flavorandfortune.com/dataaccess/article.php?ID=250

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25. LOQUAT (*Eriobotrya japonica,* LINDEL)

A fruit of wide appeal, the loquat, *Eriobotrya japonica* Lindl., (syn. *Mespilus japonicus* Thunb.), of the rose family, Rosaceae, has been called Japan, or Japanese, plum and Japanese medlar. The loquat is indigenous to southeastern China and possibly southern Japan, though it may have been introduced into Japan in very early times. It is said to have been cultivated in Japan for over 1, 000 years. Cultivation spread to India and southeast Asia, the medium altitudes of the East Indies, and Australia, New Zealand and South Africa. Chinese immigrants are assumed to have carried the loquat to Hawaii.

Food Uses

It is commonly eaten as a fresh fruit. Loquat can also be processed in several ways, such as jam, jelly and chutney. Seeds are usually taken out from the fruits, otherwise they may impart a bitter taste. They are delicious simply stewed with a little sugar added. The fruits are also used in gelatin desserts or as pie-filling, or are chopped and cooked as a sauce. Loquats canned in sirup are exported from Taiwan. Some people prepare spiced loquats (with cloves, cinnamon, lemon and vinegar) in glass jars. The fruit is also made into jam and, when slightly underripe, has enough pectin to make jelly. The jelly was formerly manufactured commercially in California on a small scale.

Other Uses

Wood: The wood is pink, hard, close-grained, medium-heavy. It has been used instead of pear wood in making rulers and other drawing instruments.

Animal feed: The young branches have been lopped for fodder.

Perfume: In the 1950's, the flowers attracted the interest of the perfume industry in France and Spain and some experimental work was done in extraction of the essential oil from the flowers or leaves. The product was appealing but the yield was very small.

Nutritonal Composition of Loquat

Component	Quantity	Component	Quantity
Water	87.4 g/100g	Calcium	0.03 mg/100 g
Carbohydrates	10.2 g/100 g	Phosphorus	0.02 mg/100 g
Protein	0.7 g/100 g	Iron	0.7 mg/100 g
Mineral	0.5 g/100 g	Potassium	1.216 g/ 100 g
Fat	0.3 g/100 g	Vitamin A	2,340 I.U./100 g
Fibre	0.9 g/100 g	Ascorbic Acid	3 mg /100 g

(Bose and Mitra,1985; Morton, 1987)

Phytochemicals

The fruit contains laevulose, sucrose and malic acid and lesser amounts of citric, tartaric and succinic acid. The pulp contains the carotenoids *B*-carotene (33%); *y*-carotene (6%); cryptoxanthin (22%), lutein, violaxanthin, neoxanthin (3-4% each). The peel is 5 times richer than the pulp in carotenoids which are similar to those in apricots. Sucrose, fructose, glucose and sorbitol were the major sugars in loquat fruits. Among the antioxidnats phenolics and flavonoids were the main bioactive compounds besides total carotenoid and vitamin C (Xu and Chen, 2011). Nine triterpenes were characterized as ursolic acid, oleanolic acid, 2α-hydoxyursolic acid, maslinic acid, tormentic acid, 2α, 19α-dihydroxy-3-oxo-urs-12-en-28-oic acid, hyptadienic acid and a mixture of 3-*O*-*cis*-*p*-coumaroyltormentic acid and 3-*O*-*trans*-*p*-coumaroyltormentic acid from callus induced from axenic leaves of loquat (Taniguchi et al.,, 2002). From an extract of the leaves of loquat (*E. japonica*) a new polyhydroxylated triterpene was isolated, as well as 3 known triterpenes. The new compound was identified as 3β,6α,19α-trihydroxyurs-12-en-28-oic acid.(Liang et al.,, 1990). The antioxidant activity of *Eriobotrya japonica* was determined by measuring the radical scavenging effect on DPPH (1,1-diphenyl-2-picrylhydrazyl) radical and lipid peroxidation produced when mouse liver homogenate was exposed to the air at 37°C, using 2-thiobarbituric acid (TBA). Antioxidant chlorogenic acid, quercetin-3-sambubioside from*n*-BuOH fraction, and methyl chlorogenate, kaempferol- and quercetin-3-rhamnosides, together with the inactive ursolic acid and 2α-hydroxyursolic acid from EtOAc fraction were isolated by Jung et al (2010).

Nishioka et al (2002) have reported that, in addition to aromatic compounds, *Eriobotrya japonica* seeds contain unsaturated fatty acids, such as linoleic acid and linolenic acid, and plant sterols, such as b -sitosterol, (Nishioka et al., 2002) and a 70% ethanol extract is effective for the prevention and treatment of disorders, such as hepatopathy12) and nephropathy (Hamada et al.,, 2004).

Pharmacological Evidence of its Medicinal properties

Eriobotrya japonica has long been used as a pharmaceutical plant. Particularly, the leaves of *Eriobotrya japonica* LINDEL. are used in a traditional herbal remedy for skin diseases, inflammation, cough and expectoration. Leaves of *Eriobotrya japonica* LINDEL. have recently been shown to contain polyphenols, and a blood glucose-lowering action,(De Tommasi, et al., 1991; Roman – Ramos et al., 1991; Alipi and Allipi, 1990) anti-inflammatory action (Young et al., 1994; De Tammasi et al., 1992) and anti-cancer action(Ito et al., 2000) have been reported.

All of the triterpenes isolated from the callus tissues showed an inhibitory effect comparable to (−)-epigallocatechin gallate (EGCG) of green tea on the activation of Epstein–Barr virus early antigen (EBV-EA) induced by 12-*O*-tetradecanoylphorbol-13-

acetate (TPA). 2α, 19α-Dihydroxy-3-oxo-urs-12-en-28-oic acid was the most potent inhibitor among them and caused a significant delay of two-stage carcinogenesis on mouse skin (Taniguchi et al., 2002)

The effects of the constituent sesquiterpene glycosides **1 - 3** and polyhydroxylated triterpenoids **5 - 6** isolated by MeOH extraction of *Eriobotrya japonica* were studied in genetically diabetic mice (C57BL/KS-db/db/Ola) and normoglycemic rats. The sesquiterpene glycoside **3** and the polyhydroxylated triterpenoids **5** and **6** produced a marked inhibition of glycosuria. Furthermore, **5** and **6** were able to reduce blood glucose levels in normoglycemic rats. While there are already some data reported on hypoglycemic activity of polyhydroxylated triterpenoids, there are no previous data showing hypoglycemic activity of sesquiterpene glycosides (De Tommasi, et al., 1991).

Sixteen triterpene acids, *viz.*, five of the oleanane-type (1—5), nine of the ursane-type (6—14), and two of the lupane-type (15, 16), were isolated and identified from the ethyl acetate-soluble fraction of the methanol extract of the leaves of loquat. Twelve of these compounds, 1—4, 6, 8—13, and 15, were evaluated for their inhibitory effects on 12-*O*-tetradecanoylphorbol-13-acetate (TPA)-induced inflammation (1m g/ear) in mice. All the compounds tested showed a marked anti-inflammatory effect, with a 50% inhibitory dose (ID50) of 0.03—0.43 mg per ear. In addition, an evaluation against the Epstein-Barr virus early antigen (EBV-EA) activation induced by TPA for all of the compounds, 12 and 13 showed potent inhibitory effects on EBV-EA induction. Furthermore, euscaphic acid (12) exhibited marked antitumor-promoting activity in an *in vivo* two-stage carcinogenesis test of mouse tumor by using 7,12-dimethylbenz[*a*]anthracene (DMBA) as an initiator and TPA as a promoter (Banno et al., 2005). Nishioka et al (2002) reported that 70% EtOH and MeOH extract of loquat seed inhibited the development of liver fibrosis in hepatopathic rats, thus exhibiting potent improvement.The unsaturated linolenic and linoleic acids and the sterol b -sitosterol contained in these extracts may also contribute to the improvement of liver function.

Antioxidant flavonoids and chlorogenic acid from loquat also showed prominent inhibitory activity against free radical generation in dichlorofluorescein (DCF) method (Jung et al., 2010). The radical scavenging activities and inhibitory activities of loquat seed extract on lipid peroxidation differed among the solvent fractions and components. In the *n*-BuOH, MeOH and H2O fractions, radical scavenging activity and inhibitory activity on lipid peroxidation were high. In addition, these fractions contained abundant polyphenols, and the radical scavenging activity increased with the polyphenol content. In the low-polar Hex and EtOAc fractions, the radical scavenging activity was low, but the lipid peroxidation inhibition activity was high. These fractions contained b -sitosterol, and the inhibitory activity on lipid peroxidation was high. Based on these findings, the antioxidative activity of *Eriobotrya japonica* seed extract may be derived from many components involved in a complex mechanism, resulting in high activity (Yokota et al., 2006).

Toxicity

There have been instances of poisoning in poultry from ingestion of loquat seeds. The seeds contain amygdalin (which is converted into HCN); also the lipids, sterol, β-sitosterol, triglyceride, sterolester, diglyceride and compound lipids; and fatty acids, mainly linoleic, palmitic, linolenic and oleic. There is amygdalin also in the fruit peel.
The leaves possess a mixture of triterpenes, also tannin, vitamin B and ascorbic acid; in addition, there are traces of arsenic. Young leaves contain saponin. Some individuals suffer headache when too close to a loquat tree in bloom, The emanation from the flowers is sweet and penetrating.

Health Benefits and Curative Properties

Anti-Oxidating Properties: Loquat leaf extract benefits our body in different ways. It acts as a mucolytic agent and helps in diluting thick mucous in the body that contains toxic substances. Also its antioxidant properties help to release antioxidants which have the ability to neutralize harmful toxins and eradicate free radicals from the body that may lead to numerous health complications. Hence, loquat leaf extract prevents various diseases, improves body's immune system and increases your life expectancy.

Fights Diabetes: Another important health benefit of loquat leaf is that it helps to fight against diabetes. The leaf comprises variety of chemicals, known as triterpenes, of which tormentic acid has been known to increase insulin production in the body. It also acts as an anti-diabetic agent as it releases a set of natural bodily chemicals known as polysaccharides which help to reduce diabetes by increasing insulin production. Besides these, loquat leaf extract also supports pancreas, either by supplementing its insulin production or by regenerating its cells. Hence, we can say that loquat leaf helps in treating diabetes in a natural way.

Detoxifying Properties: Loquat leaves detoxifying properties also help the liver. It contains a substance called Amygdalin (B-17), which is known to fight liver disorders or malfunctions and improves the liver's ability to process and get rid of poisons or toxic substances from the body.

Combats Skin Problems: Loquat leaf extract also benefits the skin by reducing skin inflammation and preventing various skin disorders. The extract of this leaf is commonly used in many topical creams and applied to fight against edema and histamine-induced skin contraction. The cream not only heals skin inflammation or irritation but also provides a soothing effect to it. Loquat leaf also helps to fight against skin cancer. Basically, the leaf contains chemicals that can slow skin cancer by suppressing the cancer cells ability to reproduce and grow.

Anti-Viral Properties: Research shows that loquat leaf releases a variety of acids that contain anti-viral properties. Megastigmane glycosides and polyphenolic constituents are two chemicals that have viral antigen properties. Moreover, loquat leaf is also believed to

have a restrictive effect on the HIV virus, though mild. Basically, the leaf contains 2-alpha-hydoxyursolic acid which contains the anti-HIV effect.

Other Benefits: Loquat leaf is often used to make medicinal teas. Loquat leaf tea helps to reduce vomiting and thirst, and also alleviates diarrhea, depression, and swelling.

(**http://www.buzzle.com/articles/loquat-leaf.html)**

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26. MANGOSTEEN (*Garcinia mangostana* L.)

Garcinia mangostana Linn. (GML) belongs to the family of Guttiferae and is named "the queen of fruits". It is cultivated in the tropical rainforest of some Southeast Asian nations like Indonesia, Malaysia, Sri Lanka, Philippines, and Thailand. People in these countries have used the pericarp (peel, rind, hull or ripe) of GML as a traditional medicine for the treatment of abdominal pain, diarrhea, dysentery, infected wound, suppuration, and chronic ulcer. Experimental studies have demonstrated that extracts of GML have antioxidant, antitumoral, antiallergic, anti-inflammatory, antibacterial, and antiviral activities. The pericarp of GML is a source of xanthones and other bioactive substances (Padreza et al., 2008). The mangosteen fruit is round in shape, dark-purple, 2 to 3 inches in diameter and contains 4 to 8 segments of snow-white, delicious soft flesh. The fruit may or may not contain seeds. Encasing the flesh is a purple skin 6 to 10 cm thick. Because of its taste and medicinal properties, the mangosteen is often called "The Queen of Fruits". For centuries, the mangosteen has been honored and cherished by the peoples of Southeast Asia (Morton, 1987).

Uses

Mangosteen is mainly used as a fresh fruit. Aril of the seed is edible after being boiled in water. The cortex of the fruit contain tannin, and is used as a commercial dye. The rind of fruit is astringent, which is used in chronic dysentery and diarrhea. The bark and young leaves are used to gargle for sore throat. It contain a crystalizable substance known is mangosteen.

Nutritional Composition

Component	**Quantity**	**Component**	**Quantity**
Water	79.2 g/100 g	Calcium	11 mg/100 g
Protein	0.5 g/100 g	Phosphorus	17 mg/100 g
Carbohydrates	19.8 g/100 g	Iron	0.9 mg/100 g
Citric acid	0.63 g/100 g	Vitamin A	14 IU mg100 g
Fibre	0.3 g/100 g	Thiamine	0.09 mg/100 g
Ascorbic acid	66 mg/100 g	Riboflavine	0.06 mg/100 g
Energy	60-63 Kcal/100 g	Niacin	0.10 mg/100 g

(Bose and Mitra, 1990)

Phytochemicals

Many tropical plants have interesting biological activities with potential therapeutic applications . Studies shows that the rind (skin) has anti-oxidant, anti-bacterial, anti-fungal and anti-tumor properties. Initial results also reveals that mangosteen have anti-histamine and anti-inflammatory medicinal properties. The active therapeutic compound found in mangosteen is called "Xanthones". The rind of partially ripe fruits yields a polyhydroxy-xanthone derivative termed mangostin, also ß-mangostin. That of fully ripe fruits contains the xanthones, gartanin, 8-disoxygartanin, and normangostin. A derivative of mangostin, mangostin-e, 6-di-*O*-glucoside, is a central nervous system depressant and causes a rise in blood pressure.

Xanthones provides many times more anti-oxidants than Vitamin C & E. Xanthones have been receiving much attention lately from researchers and scientist for its medicinal value. It appears to benefit every organ of the body. The whole mangosteen fruit is the single, best source of Xanthones. The strong anti-oxidant properties of the mangosteen fruit fights free radicals in the body. This helps strengthen the immune system, promote joint and cartilage function, helps support a strong respiratory system and helps maintain good health. Phytin (an organic phosphorus compound) constitutes up to 0.68% on a dry-weight basis. Mangosteen twigs are used as chewsticks in Ghana. The fruit rind contains 7 to 14% catechin tannin and rosin, and is used for tanning leather in China. It also yields a black dye. (Morton, 1987).

Prenylated xanthones isolated from GML have been extensively studied; some members of these compounds possess antioxidant, antitumoral, antiallergic, anti-inflammatory, antibacterial, antifungal and antiviral properties. Xanthones have been isolated from pericarp, whole fruit, heartwood, and leaves. The most studied xanthones are alpha-, beta-, and gamma-mangostins, garcinone E, 8-deoxygartanin, and gartanin (Padreza et al.,2008).

Pharmacological Evidence for medicinal properties

Methicillin-resistant Staphylococcus aureus (MRSA) is a major nosocomial pathogen which causes severe morbidity and mortality worldwide. Seventeen Thai medicinal plants were investigated for their activity against MRSA. Chomnawang et al., (2009) identified *Garcinia mangostana* as the most potent plant, and its activity was traced to the prenylated xanthone, alpha-mangostin (MIC and MBC values of 1.95 and 3.91 microg/ml, respectively). Propionibacterium acnes and Staphylococcus epidermidis have been recognized as pus-forming bacteria triggering an inflammation in acne.

Chomnawang et al., (2005) evaluated antimicrobial activities of Thai medicinal plants against these etiologic agents of acne vulgaris. Crude extracts were tested for antimicrobial activities by disc diffusion and broth dilution methods. The results from the disc diffusion method showed that 13 medicinal plants could inhibit the growth of Propionibacterium acnes. The concluded that Garcinia mangostana had a strong inhibitory effect on Propionibacterium acnes and Staphylococcus epidermidis.

The methanol extracts of 20 selected medicinal plants were investigated for their effects on the respiratory burst of human whole blood, isolated human polymorphonuclear leukocytes (PMNs) and isolated mice macrophages using a luminol/ lucigenin-based chemiluminescence assay (Jantan et al., 2010). For macrophage cells, the extracts which showed strong suppressive activity for luminol-based chemiluminescence were C. xanthorrhiza and *Garcinia mangostana* L. The results suggested that some of these plants were able to modulate the innate immune response of phagocytes at different steps, emphasizing their potential as a source of new immunomodulatory agents.

Health Benefits and Curative Properties

Anti-tumor & anti-cancer, Anti-inflammatory properties, Prevents & treats infections,
For treatment of diarrhoea, cystitis, eczema, gleet and gonorrhoea.
Anti-proliferative activity against human breast adenocarcinoma cell line.
Anti-micro bacterial activity Inhibitory activity against histamine release.

How to Use as a curative agent?

- Dried and powdered mangosteen rind (skin) is given to cure dysentery.
- The powder can be made into a cream and applied to skin to treat eczema and other skin disorders.
- A decoction of the rind (boil in water) is cure for gonorrhoea, cystitis, diarrhoea and gleet.
- A decoction of the whole fruit, bark and leaves of the mangosteen tree can also be used.
- The sliced and dried rind is powdered and administered to overcome dysentery.
- Made into an ointment, it is applied on eczema and other skin disorders.
- The rind decoction is taken to relieve diarrhea and cystitis, gonorrhea and gleet and is applied externally as an astringent lotion. A portion of the rind is steeped in water overnight and the infusion given as a remedy for chronic diarrhea in adults and children.
- Filipinos employ a decoction of the leaves and bark as a febrifuge and to treat thrush, diarrhea, dysentery and urinary disorders.
- In Malaya, an infusion of the leaves, combined with unripe banana and a little benzoin is applied to the wound of circumcision.

- A root decoction is taken to regulate menstruation. A bark extract called "amibiasine", has been marketed for the treatment of amoebic dysentery in Malaya.

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27. KOKUM (*Garcinia indica* L.)

Garcinia indica **L.**, a plant in the mangosteen family (Clusiaceae), commonly known as ***kokum***, is a fruit tree that has culinary, pharmaceutical, and industrial uses. the extract/concentrate of this fruit is called *aagal* in Konkani and Marathi. It is ready to use for preparation of *sol kadhi* when mixed with coconut milk. The outer cover of fruit is dried in the sun to get *aamsul* or *kokam*. It is used as a slightly sour spice in recipes from Maharashtra that yields peculiar taste and dark red colour. It is a preferred substitute for tamarind in curries and other dishes from Konkan. It is also used in Konkani cuisine, in Gujarat, and some cuisines of South India. As *kudam puli*, it is an essential ingredient of traditional fish recipes of Kerala.(http://en.wikipedia.org/wiki/Garcinia_indica accessed on 28.04.2011).

Uses

The acidic sweet fruit is mainly used as souring agent for vegetable curry and dal. Sun drying is practiced for preservation. Dried Kokum fruit rinds are widely used in cooking as they impart a sweetish-tangy flavor to the food. The fruits contain citric acid, acetic acid, malic acid, ascorbic acid, hydroxycitric acid and garcinol. Fresh are cut in to halves and the freshly portion containing the seed is removed. The rind which constitutes about 50 per cent of the fruit is repeatedly soaked in the juice of the pulp during sun drying. It makes excellent beverage with pleasant flavour. Kokum butter is a product of commerce obtain from seed. It is also used in soap and candle making and suitable for ointment and other pharmaceutical preparations. This fruit is known to reduce obesity and regulate blood cholesterol level.

Nutritional Composition

Component	**Quantity**	**Component**	**Quantity**
Moisture	80.00 g/100 g	Total ash	2.57 g/100 g
Starch	1.00 g/100 g	Tannin	2.85 g/100 g
Protein	1.92 g/100 g	Ascorbic acid	60 mg/100g
Crude fat	10.00 g/100 g	Pectin	5.71 mg/100g
Crude fibre	14.92 g/100 g		

(Bose and Mitra, 1990)

Phytochemicals

Kokum fruits contain citric acid, acetic acid, polyphenol, carbohydrates, malic acid, ascorbic acid, hydroxycitric acid, garcinol, (Cadenas and Packer, 1996; Sies, 1996), anthocyanin pigments and ascorbic acid (Peter, 2001). The fruit shows presence of anthocyanins, which are pigmented *flavonoids*. Anthocyanins present are Cyanidin-3-sambubioside, Cyanidin-3-glucoside) and fatty acids are palmitic, stearic, oleic, linoleic acid. Anthocyanins are water-soluble and help in scavenging free radicals. Flavonoids are known for their antioxidant activity.

The kokum fruit is cooling, antiseptic, purifies the blood and fights cholesterol. One of the ingredients of kokam, hydroxycitric acid (HCA), has been patented for use as an hypocholesterolaemic agent. HCA is a potential anti-obesity agent. It suppresses fatty acid synthesis, lipogenesis, food intake and induces weight loss (Jena et al.,2002). Garcinol, a polyisoprenylated benzophenone purified from *G. indica* fruit rind, displays antioxidant, anti-cancer and anti-ulcer properties(Yamaguchi et al., 2000; Selvi et al., 2003).

In India Kokam is used as a water extract and the commercial formulation as syrup is also available. Among all kokam extracts, kokam syrup was the most potent in the inhibition of ABTS radical formation with AEAC of 1.005 mM, followed by aqueous extract and boiled aqueous extract with AEAC of 0.754 and 1.19 mM (Mishra et al., 2006).

Pharmacological Evidence of its medicinal properties

The potent antioxidant property of phytochemicals in kokam combats free radicals, which kill the tissues, cells and damage organs of the body. Therefore by killing these free radicals Kokum's antioxidant properties help to prevent diseases like cancer, osteoporosis and arthritis from developing in the body. Most of the currently available anti-diabetic therapies reduce the fasting blood glucose but have a little impact on postprandial hyperglycemia. Postprandial hyperglycemia is an independent risk factor for cardiovascular diseases (Ratner, 2001). Aqueous extract of G. indica significantly decreased both the fasting and postprandial blood glucose in type 2 diabetic rats. The extract also restored the erythrocyte GSH in type 2 diabetic rats. The extract also restored the erythrocyte GSH in type 2 diabetic rats. Drug at higher dose, i.e. 200 mg/kg, had a more pronounced effect (Kirana and Srinivasan, 2010).

When we consume a carbohydrate-rich diet, glucose is partially used and stored in the form of glycogen in liver and muscles. The excess glucose is converted to lipids and stored as fat throughout the body which causes weight gain. ATP-citrate lyase is an enzyme that cleaves citrate, produces oxaloacetate and acetyl-CoA (a key molecule used in fat storage). Watson et al., showed that HCA inhibits this crucial catalytic reaction, thus preventing glucose conversion to fat. Watson et al.,., showed that HCA inhibits this crucial catalytic reaction, thus preventing glucose conversion to fat. In mice models, researchers have shown that HCA will suppress appetite and instigate a reduced caloric intake. Scientists have proposed that appetite suppression is initiated when HCA infiltrates the blood-brain barrier, and effects acetylcholine levels.

As many as 70% of all drugs approved for cancer treatment between 1981-2002 were either natural products or based on natural products (Newman et al., 2003). The mechanism by which most natural products mediate their effects, however, is less well understood. It is indicated that garcinol can potentiate TRAIL induced apoptosis through upregulation of death receptors and downregulation of antiapoptotic proteins. Prasad et al., (2011) found that the induction of death receptors by garcinol was not cell type specific. Rather, it was observed in a wide variety of cell types including colon, breast, prostate, kidney, leukemic, and esophageal cancer cells. Induction of TRAIL receptors in some cells, however, was much more pronounced than other cell types. Thus garcinol is likely to potentiate the effect of TRAIL in a wide variety of cells. It has been suggested that oxidative stress plays a major role as a common mediator of cell death (Jacobson, 1996). Prasad et al., (2011), suggested, considering that garcinol alone is highly safe and exhibits anticancer activities *in vitro* (Pan et al., 2001; Liao et al., 2005; Hong et al., 2007; Balasubramanyam et al., 2004) and *in vivo* (Tanaka et al., 2000; Yoshida et al., 2005,), against a wide variety of tumors, its potential use in combination with TRAIL should be explored.

Free radicals have been implicated in the etiology of several major human ailments, including cancer, cardiovascular diseases, neural disorders, diabetes and arthritis (Sies, 1996; Yoshikawa et al., 2000; Devasagayam, et al., 2004). Antioxidants are micronutrients that have gained importance in recent years due to their ability to neutralize free radicals or their actions (Candenas and Packer, 1996). As Kokam is a rich source of antioxidants many of the other curative and disease preventive properties of its nutrients or phytochemicals can be attributed to that hypothesis which is receiving wide acceptance.

Health Benefits and Curative Properties

Various parts of the Kokam tree such as the seeds and bark of the root are used in Ayurvedic preparations since they offer a myriad of health benefits.

- Kokum fruits contain rich amounts of anti-oxidants that bind with free radicals and prevent oxidative damage to body cells. They also promote cell regeneration and repair.

- Kokum juice is especially popular during scorching summer months as it has a cooling effect on the body and shields the body against dehydration and sunstroke. It also helps in bringing down fever and allergic reactions.

- Kokum seeds contain a high percentage of oil that freezes to form Kokum butter. Kokum butter is extensively used in the pharmaceutical and cosmetic industry as it works wonders on dry, chapped, sensitive, irritated or burnt skin.

- Kokum butter is rapidly gaining popularity over cocoa butter as an intensive skin moisturizer.
- Due to its soothing and healing properties, it is also applied directly to wounds and infected areas on the skin.
- Kokum butter is rich in healthy fats like stearic and oleic acids and can also be used as edible oil.
- Extracts from the Kokum fruit are traditionally used to relieve gastric problems like acidity, flatulence, constipation and indigestion.
- Kokum juice is a healthier and far more refreshing option as compared to commercial bottled drinks. It acts as an appetite stimulant and also has anti-helmintic properties.
- Ayurvedic medicine also uses Kokum infusions to treat piles, dysentery and infections. Kokum is known to strengthen the cardio-vascular system and stabilize liver function.
- The hydroxycitric acid present in the fruit fights cholesterol and curbs lipogenesis, thus aiding weight loss.

(http://www.brighthub.com/health/alternative-medicine/articles/15199.aspx#ixzz0uAKd1f2y)

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28. APPLE *(Malus domestica* L.)

The **apple** is the pomaceous fruit of the apple tree, species ***Malus domestica*** in the rose family (Rosaceae). It is one of the most widely cultivated tree fruits, and the most widely known of the many members of genus *Malus* that are used by humans.

The tree originated in Western Asia, and there are more than 7,500 known cultivars of apples, resulting in a range of desired characteristics. Delicious and crunchy apple is one of the popular fruit that contain an impressive list of essential nutrients, which are required for normal growth and development and overall nutritional well-being.

Apple fruit contains good quantities of *vitamin-C* and *beta carotene.* Vitamin C is a powerful natural antioxidant. Consumption of foods rich in vitamin C helps body develop resistance against infectious agents and scavenge harmful, pro-inflammatory free radicals from the body. Apples are rich in antioxidant phyto-nutrients *flavonoids* and *polyphenols.* The total measured anti-oxidant strength **(ORAC value)** of 100 g apple fruit is 5900 TE. The important flavonoids in apples are **quercetin, epicatechin,** and **procyanidin B2**. Apples are also good in **tartaric acid** that gives tart flavor to them. These compounds help body protect from deleterious effects of free radicals.

In addition, apple fruit is a good source of B-complex vitamins such as riboflavin, thiamin and pyridoxine (vitamin B-6). Together these vitamins help as co-factors for enzymes in metabolism as well as in various synthetic functions inside the body. Apple also contains small amount of minerals like potassium, phosphorus and calcium. Potassium in an important component of cell and body fluids helps controlling heart rate and blood pressure; thus counters the bad influences of sodium.

Uses

Apples can be canned or juiced. They are milled to produce apple cider (non-alcoholic, sweet cider) and filtered for apple juice. The juice can be fermented to make cider (alcoholic, hard cider), ciderkin, and vinegar. Through distillation, various alcoholic beverages can be produced, such as applejack, Calvados and apfelwein. Pectin and apple seed oil may also be produced.

Apples are an important ingredient in many desserts, such as apple pie, apple crumble, apple crisp and apple cake. They are often eaten baked or stewed, and they can also be dried and eaten or reconstituted (soaked in water, alcohol or some other liquid) for later use. Puréed apples are generally known as apple sauce. Apples are also made into apple butter and apple jelly. They are also used (cooked) in meat dishes.

Nutritional Composition of Apple fruit

Nutritional compositon (per 100 g)		
Energy 229 kJ (54 kcal)	**Vitamins**	Tyr 5 mg
Water 85.3 g	Carotene 45 µg	Val 12 mg
Protein 0.3 g	Vitamin E 490 µg	
Lipids 0.4 g	Vitamin K 0-5 µg	**Carbohydrates**
Carbohydrate 11.8 g	Vitamin B1 35 µg	Glucose 2210 mg
Organic acids 0.6 g	Vitamin B2 30 µg	Fructose 6040 mg
Fiber 2.3 g	Nicotinamide 300 µg	Sucrose 2470 mg
Minerals 0.3 g	Pantothenic acid 100 µg	Starch 600 mg
	Vitamin B6 45 µg	Sorbit 510 mg
Minerals	Biotin 1-8 µg	
Sodium 3 mg	Folic acid 7 µg	**Lipids**
Potassium 145 mg	Vitamin C 12 mg	Palmitic acid 50 mg
Magnesium 6 mg		Stearic acid 10 mg
Calcium 7 mg	**Amino Acids**	Oleic acid 20 mg
Manganese 65 µg	Arg 8 mg	Linolic acid 100 mg
Iron 480 µg	His 6 mg	Linoleic acid 20 mg
Copper 100 µg	Ile 10 mg	
Zinc 120 µg	Leu 16 mg	**Other**
Phosphorus 12 mg	Lys 15 mg	Malic acid 550 mg
Chloride 2 mg	Met 3 mg	Citric acid 16 mg
Fluoride 7 µg	Phe 9 mg	Oxalic acid 500 µg
Iodine 2 µg	Thr 8 mg	Salicylic acid 310 µg

Selenium 1-6 µg	Trp 2 mg	Purines 3 mg

Reference: Deutsche Forschungsanstalt für Lebensmittelchemie, Garching bei München (ed), **Der kleine "Souci-Fachmann-Kraut" Lebensmitteltabelle für die Praxis**, WVG, Stuttgart 1991

Phytochemicals

Apples contain a large concentration of flavonoids, as well as a variety of other phytochemicals, and the concentration of these phytochemicals may depend on many factors, such as cultivar of the apple, harvest and storage of the apples, and processing of the apples. The concentration of phytochemicals also varies greatly between the apple peels and the apple flesh. Some of the most well studied antioxidant compounds in apples include quercetin-3-galactoside, quercetin-3-glucoside, quercetin-3-rhamnoside, catechin, epicatechin, procyanidin, cyanidin-3-galactoside, coumaric acid, chlorogenic acid, gallic acid, and phloridzin (Jeanelle and Liu, 2004). Recently researchers have examined the average concentrations of the major phenolic compounds in six cultivars of apples. They found that the average phenolic concentrations among the six cultivars were: quercetin glycosides, 13.2 mg/100 g fruit; vitamin C, 12.8 mg/100 g fruit; procyanidin B, 9.35 mg/ 100 g fruit; chlorogenic acid, 9.02 mg/100 g fruit; epicatechin, 8.65 mg/100 g fruit; and phloretin glycosides, 5.59 mg/100 g fruit (Lee et al, 2003). The compounds most commonly found in apple peels consist of the procyanidins, catechin, epicatechin, chlorogenic acid, phloridzin, and the quercetin conjugates. In the apple flesh, there is some catechin, procyanidin, epicatechin, and phloridzin, but these compounds are found in much lower concentrations than in the peels. Quercetin conjugates are found exclusively in the peel of the apples. Chlorogenic acid tends to be higher in the flesh than in the peel (Escarpa and Gonzalez, 1998).

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Pharmocologica Evidence for the medicinal properties of apple

We live in a highly oxidative environment, and many processes involved in metabolism may result in the production of more oxidants. Humans, and all animals, have complex antioxidant defense systems, but they are not perfect and oxidative damage will occur. Both cardiovascular disease and cancer are thought to be particularly the results of oxidative stress, which can lead to damage of the larger biomolecules, such as DNA, lipids, and proteins. It has been estimated that there are 10,000 oxidative hits to DNA per cell per day in humans (Ames et al, 1993).

Much of the protective effect of fruits and vegetables has been attributed to phytochemicals, which are the non-nutrient plant compounds such as the carotenoids, flavonoids, isoflavonoids, and phenolic acids. Thousands of phytochemicals have been identified in foods, yet there are still many that have not been identified. Different phytochemicals have been found to possess a range of activities, which may help in protecting against chronic disease. For example, phytochemicals may inhibit cancer cell proliferation, regulate inflammatory and immune response, and protect against lipid oxidation (Hollman and Katanm 1997; Lie, 2003). A major role of the phytochemicals is protection against oxidation.

Cancer

Several studies have specifically linked apple consumption with a reduced risk for cancer, especially lung cancer (Feskanich et al, 2000). Very few of the individual fruits and vegetables examined had a significant effect on lung cancer risk in women, however apples were one of the individual fruits associated with a decreased risk in lung cancer. Women who consumed at least one serving per day of apples and pears had a reduced risk of lung cancer (Feskanich et al, 2000). An assessment made for smoking history and food intake for 582 patients with lung cancer and 582 control subjects without lung cancer. There was a 40–50% decreased risk in lung cancer in participants with the highest intake of apples, onions, and white grapefruit when compared to those who consumed the lowest amount of these fruits. Both onions and apples are high in flavonoids, especially quercetin and quercetin conjugates (Hollman and Arts, 2000). Interestingly, the inverse association seen between apple and onion intake and lung cancer were stronger for squamous cell carcinomas than for adenocarcinomas. A reduced risk of cardiovascular disease has been associated with apple consumption.

Cardiovascular disease

Women ingesting the highest amounts of flavonoids had a 35% reduction in risk of cardiovascular events (Sesso et al, 2003). Both apple intake and broccoli intake were associated with reductions in the risk of both cardiovascular disease and cardiovascular events. Women ingesting apples had a 13–22% decrease in cardiovascular disease risk. Those who had the highest consumption of apples had a lower risk of thrombotic stroke compared to those who consumed the lowest amounts of apples (Knekt, 2000). Apple catechins may be more bioavailable than the catechin and epicatechin gallates commonly found in teas (Arts et al, 2001).

Asthma and pulmonary function

In a recent study involving 1600 adults in Australia, apple and pear intake was associated with a decreased risk of asthma and a decrease in bronchial hypersensitivity, but total fruit and vegetable intake was not associated with asthma risk or severity (Woods et al, 2003). Previously it had been found that apple intake, as well as selenium intake, was associated with less asthma in adults in the United Kingdom (Shaheen et al,

2001). Flavonoid intake in general was associated with a lower risk of asthma, and the association was attributed mainly to quercetin, hesperitin, and naringenin.

Apple and pear intake was positively associated with pulmonary function and negatively associated with chronic obstructive pulmonary disease (Tabak et al, 2001). Catechin intake was also associated with pulmonary function and negatively associated with chronic obstructive pulmonary disease. Apple consumption remained positively correlated with lung function after taking into account possible confounders such as smoking, body mass index, social class, and exercise.

Diabetes and weight loss

Not only may apples help decrease the risk of heart disease, cancer, and asthma, but apple consumption may also be associated with a lower risk for diabetes. Higher quercetin intake, a major component of apple peels, was also associated with a decreased risk in type II diabetes. Myrectin and berry intake were also associated with a decreased risk in type II diabetes, but onion, orange, grapefruit and white cabbage intake were not associated with a lowered risk (Knekt et al, 2002).

Apple and pear intake has also been associated with weight loss in middle aged overweight women in Brazil (de Oliviera et al, 2003). Approximately 400 hypercholestemic, but nonsmoking, women were randomized to one of three supplement groups: oat cookies, apples or pears, and each subject consumed one of each supplement three times per day for twelve weeks. The participants who consumed either of the fruits had a significant weight loss after 12 weeks of 1.21 kg, whereas those consuming the oat cookies did not have a significant weight loss. Those consuming fruit also had a significantly lower blood glucose level when compared to those consuming the oat cookies (de Oliviera et al, 2003).

Animal and *in vitro* studies

Antioxidant activity

Apples, and especially apple peels, have been found to have a potent antioxidant activity and can greatly inhibit the growth of liver cancer and colon cancer cells (Wolfe et al, 2003; Eberhardt et al, 2000). The total antioxidant activity of apples with the peel was approximately 83 μmol vitamin C equivalents, which means that the antioxidant activity of 100 g apples (about one serving of apple) is equivalent to about 1500 mg of vitamin C. However, the amount of vitamin C in 100 g of apples is only about 5.7 mg (Eberhardt et al, 2000). Vitamin C is a powerful antioxidant, but this research shows that nearly all of the antioxidant activity from apples comes from a variety of other compounds. Vitamin C in apples contributed less than 0.4% of total antioxidant activity.

Antiproliferative activity

Apples have been shown to have potent antiproliferative activity in several studies. When Caco-2 colon cancer cells were treated with apple extracts, cell proliferation was inhibited in a dose-dependent manner reaching a maximum inhibition of 43% at a dose of 50 mg/mL. The same trend was seen in Hep G2 liver cancer cells

with maximal inhibition reaching 57% at a dose of 50 mg/mL (Eberhardt et al, 2000). Eberhardt et al (2000) proposed that it is the unique combination of phytochemicals in the apples that are responsible for inhibiting the growth of tumor cells. Apples had the third highest antiproliferative activity when compared to eleven other commonly consumed fruits (Sun et al, 2002.

Inhibition of lipid oxidation

Addition of apple phenolics to human serum decreased diphenylhexatriene-labeled phosphatidylcholine (DPHPC) oxidation in a dose dependent manner (Mayer et al, 2001). DPHPC is incorporated into low-density lipoprotein (LDL), high-density lipoprotein and very low-density lipoprotein (VLDL) fractions and is an indicator of oxidation. Apple ingestion led to a decrease in DPHPC oxidation, reflecting the apples antioxidant activity *in vivo*.

Rats fed apple juice also had a decreased level of malondialdehyde (MDA), a marker of lipid peroxidation. The effect of apple juice on lipid oxidation has also been examined *in vivo* in human subjects. In a study involving four women and one man, ingestion of high levels of a 1:1 mixture of apple juice and black currant juice increased the antioxidant status of the blood and decreased lipid oxidation. Glutathione peroxidase also increased in humans consuming apple juice. Plasma MDA decreased over the seven-day intervention period when the subjects ingested the highest dose of the apple juice and black currant mixture (1500 mL). Despite the antioxidant effect on lipoproteins, apple juice intake had a pro-oxidant effect on plasma proteins in both humans and rats (Breinholt et al, 2003; Young et al, 1999).

Cholesterol-lowering effects

Some of the apple's protective effect against cardiovascular disease may come from its potential cholesterol-lowering ability. Aprikian et al (2001) found that when cholesterol fed rats were supplemented with lyophilized apples, there was a significant drop in plasma cholesterol and liver cholesterols and an increase in high-density lipoproteins (HDL). In rats supplemented with cholesterol, apple pomace fiber and sugar beet fiber, the plasma lipids were significantly lower than in rats without the dietary fiber (Leontowizc et al, 2001). This work suggests that there is a beneficial interaction between fruit fiber and polyphenolic components and also supports the benefits of eating whole fruits as opposed to dietary supplements.

Other health effects

Aside from chronic disease, apples may be used to help combat other prevalent disease in the world. Recently it has been found that crude extracts from immature apples actually inhibited enzymatic activities of cholera toxin in a dose dependent manner (Saito et al, 2002).

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29. PEAR (*Pyrus communis*.L)

The pear (naspati) is a popular orchard fruit. It ranks high among sub-acid fruits as it contains less acid than almost any other fruit. It has been used as a food from time immemorial.The pear is a wholesome fruit and at par in importance with the apple. The flesh of the pear is, however, slightly harder than the apple, but it is more juicy than the apple. Like the apple, it has few seeds. It grows on a comparatively large tree. It has generally yellow and brown colour. Sometimes, there is also a tint of red. It has several several varieties across the world.

Uses

Pear is primarily cultivated for fresh consumption. It is also used in making juice and wine. Canning and drying are common in pear. Pear can also be candied and sweet pickled. It is also a good source of vegetable fiber, an amount that is slightly less than the apple; the pear contains a greater amount of insoluble fiber rich in lignin. Soluble fiber is more effective against cholesterol, while the insoluble is a more effective laxative.

(http://en.wikipedia.org/wiki/Pear)

Nutritional Compositon of Pear

Constituent	**Quantity**	**Constituent**	**Quantity**
Moisture	86.00 g/100 g	Calcium	8.00 mg/100 g
Carobohydrates	11.90 g/100 g	Phosphorus	15.00 mg/100 g
Proteins	0.60 g/100 g	Iron	0.50 mg/100 g
Fats	0.20 g/100 g	Carotene	28 mg/100 g
Minerals	0.30 g/100 g	Thiamine	0.06 mg/100 g
Fibre	1.00 g/100 g	Riboflavin	0.03 mg/100 g
Energy	52 Kcal/100 g	Niacin	0.20 mg/100 g

(Gopalan et al., 1985)

Pears contain small amounts of vitamins C, E, and B. The most important of the minerals they contain are potassium, magnesium, and iron. They are also a good source of trace elements such as copper and manganese, and in lower proportion, zinc. The pear's vitamin and mineral content is slightly greater than that of apples.

The pear is also a diuretic, remineralizing, a mild astringent, and refreshing. Its capacity to lower blood pressure has been known since ancient times. This is credited to its diuretic effect.

The pear also stimulates renal function, thus it is a highly recommended fruit in cases of renal failure due to nephritis or nephrosis. In addition to containing no sodium and being very low in proteins, abundant pear consumption is recommended in cases of cardiac, as well as renal edema.

Phytochemicals

Besides these nutritional components essential for various life processes in the body there are several other phytochemicals in pear which help in fighting against disease and disorder. Compounds present in the leaf of *P. communis* L. are arbutin, quercetin 3-glycosides, chlorogenic and isochlorogenic acids. The quercetin glycosides and isochlorogenic acid are present in reduced amounts particularly in varieties in East Asian countries. The varieties of East Asian origin contain flavones like, the 7-glucosides of luteolin and apigenin. In addition there were alcoholic esters of caffeic, protocatechuic, *p*-hydroxybenzoic and vanillic acids respectively with 3,4-dihydroxybenzyl alcohol 4-glucoside (*calleryanin*). Protocatechuic acid 3-glucoside was also found. The occurrence of these compounds is of particular interest since C_6---C_1 phenolic acids have not hitherto been unequivocally detected in *Pyrus* and 3,4-dihydroxybenzyl alcohol has not been previously reported as occurring in nature. Calleryanin esters of the three hydroxybenzoic acids were also found in the leaf of *Prunus lusitanica* L (Challice and Williams, 1968). The survey of polyphenols in *Pyrus sp*. showed basic pattern consisting of arbutin, chlorogenic, neochlorogenic and isochlorogenic acids, a flavonol 3-monoglycoside complex, a flavonol 3-diglycoside complex, caffeoylarbutin (hitherto unreported in *Pyrus*), and a trace of *p*-coumaroylquinic acid. The flavonol 3-monoglycoside complex and caffeoylarbutin were found in higher concentrations in mature than in young leaf.

The antioxidant properties of the studied fruits can be attributed to their content of phenolic compounds. The degree of antioxidant potential depends upon the level of total polyphenols and some phenolic acids. Total polyphenol and phenolic acid contents and TRAP values in peeled apples and their peel are significantly higher than in peeled peaches and pears and their peels. All these indices are higher in peelsthan in peeled fruits (Gorinstein et al., 2002).

Other Pyrus sp. were found to have compounds like β-sitosterol, daucosterol, oleanolic acid, and ursolic acid. These compounds could significantly inhibit the ear edema induced by xylene. The results indicated that *P. bretschneideri* had good anti-inflammatory effects and the constituents β-sitosterol, daucosterol, oleanolic acid, and ursolic acid might well account for it (Huang et al., 2010).

Pharmacological Evidence for its medicinal properties

Oxidative stress is a state of imbalance between ROS and antioxidants in favor of the former. The free radical or oxidative stress theory of aging states that oxygen-derived free radicals or oxidative stress is the underlying cause of aging and age-related diseases such as cancer, cardiovascular disease, etc. (Harman, 1956, 1981; Yu, 1996). This theory has now been accepted by many gerontologists (Prior and Cao, 2000; Wang et al., 1996). Due to accumulating evidence demonstrating the absorption of dietary flavonoids in humans and significant contributions of phytochemicals such as flavonoids to the antioxidant capacity measured in fruits and vegetables, it is conclude that these phytochemicals can be an important source of dietary antioxidants and may be responsible for the health benefits observed with increased consumption of fruits and vegetables.

The pear is also beneficial in weight loss diets because of its mild diuretic action and its depurative effect. When it is ripe and tender, the pear is digested rapidly and easily. It has a mild astringent action and works against the intestinal putrefaction and flatulence occurring in case of colitis and intestinal dyspepsia.

Health Benefits and Curative Properties

Allergies: Pears are often recommended as a hypo-allergenic fruit that is high in fiber but less likely to produce adverse reactions. Pear juice is safe to be introduced to infants as they are mild, yet healthful.

Blood pressure: Pears have anti-oxidant and anti-carcinogen glutathione which help prevent high blood pressure and stroke.

Cancer prevention: The high vitamin C and copper content act as good anti-oxidants that protect cells from damages by free radicals.

Cholesterol: The high content of pectin and dietary fibre in pears make it very useful to lower cholesterol levels.

Constipation: The pectin and crude fibre in pears is diuretic and have a mild laxative effect. Drinking pear juice regularly helps regulate bowel movements.

Energy: You can get quick and natural source of energy from pear juice, due largely to its high amounts of fructose and glucose.

Fever: The cooling effect in pear is excellent in relieving fever. Best way to bring a fever down quickly is by drinking a big glass of pear juice.

Immune booster: The anti-oxidant nutrients in pears are critical in building up immune system.

Inflammation: Pear juice has an anti-inflammatory effect and helps relieve sufferers of much pain in various inflammatory conditions.

Osteoporosis: Pears contain high level of boron. Boron helps the body to retain calcium, thus prevents or retards osteoporosis.

Pregnancy: The high content of folate (folic acid) prevents neural tube defects in infants.

Shortness of breath: The summer heat may cause children to have shortness of breath with excessive phlegm. Drinking pear juice during this period to help clear the phlegm.

Throat problem: The pears are in season during the summer for a reason. Drinking pear juice every morning and night helps to cool your body down during this time. It nourishes the throat and helps prevent throat problems.

Vocal chord: Boil two Chinese pear juice with some raw honey and drink warm. This is extremely healing for the throat and the vocal cord.

Rheumatism and Gout: Fermented juice of pear is similar to cider and it is known as perry. This beverage is beneficial in the treatment of rheumatism and gout.

(http://www.juicing-for-health.com/health-benefits-of-pear.html)

(http://www.naturalhealthcure.org/natural-diet/natural-laxative-pear.html)

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30. PEACH (*Prunus persica*. L)

The **peach** tree (*Prunus persica* L.) is a species of *Prunus* native to China that bears an edible juicy fruit called a peach. It is a deciduous tree growing to 4–10 m (13–33 ft) tall, belonging to the subfamily Prunoideae of the family Rosaceae. It is classified with the almond in the subgenus *Amygdalus* within the genus *Prunus*, distinguished from the other sub genera by the corrugated seed shell.
(http://en.wikipedia.org/wiki/Prunus_persica).

Uses

Peachs are grown both for dessert and processing purposes. It is also used for making wine. Peach fruit juice is a common drink. Peach kernel has high protein and its oil is used in food, cosmetics and pharmaceutical products. The cake after extraction of oil can be used for various purposes. Peach flowers and leaves are anthelmintic and purgative.

Nutritional Composition (Content per 100 g)

Energy 177 kJ (42 kcal) Water 87.5 g Protein 0.8 g Lipid 0.1 g Carbohydrate 8.9 g Organic acids 0.6 g Fiber 1.7 g Minerals 0.5 g **Minerals** Sodium 1 mg Potassium 205 mg Magnesium 9 mg Calcium 8 mg Manganese 110 µg Iron 480 µg Copper 50 µg Zinc 20 µg Phosphorus 25 mg Chloride 3 mg Fluoride 20 µg Iodine 1 µg	Selenium traces **Vitamins** Carotin 440 µg Vitamin B1 27 µg Vitamin B2 50 µg Nicotinamide 850 µg Pantothenic acid 140 µg Vitamin B6 25 µg Biotin 2 µg Folic acid 3 µg Vitamin C 10 mg **Amino Acids** Arg 17 mg His 17 mg Ile 13 mg Leu 30 mg Lys 30 mg Met 30 mg Phe 18 mg	Thr 25 mg Trp 5 mg Tyr 20 mg Val 40 mg **Carbohydrates** Glucose 1030 mg Fructose 1230 mg Sucrose 5720 mg Sorbitol 890 mg **Lipids** Palmitic acid 10 mg Stearic acid traces Oleic acid 30 mg Linolic acid 40 mg Linoleic acid traces **Others** Malic acid 330 mg Citric acid 240 mg Oxalic acid 0 Salicylic acid 580 µg

Source : http://www.food-allergens.de/symposium-2-4/peach/peach-allergens.htm accessed on 30.04.2011

Phytochemicals

Increasing recent interest in nutraceuticals and functional foods has led researchers to investigate the antioxidant potential of several fruits including peach. Peach could be of great interest as an important antioxidant. Simone et al., (2009) evaluated the antioxidant potential and reactivity based on luminol-enhanced chemiluminescence capacity of peach extracts (peels and fleshes) and the contribution of a major compound present in these extracts to antioxidant potential and reactivity. Their results showed, Chlorogenic acid presented a good contribution to antioxidant reactivity and potential, but the fruit extracts provided better antioxidant action than major compound (chlorogenic acid) alone, and it can be due to a synergistic or additive effect of other antioxidants present in the extracts. Vizzotto et al., (2009) evaluated twenty-two peach varieties and fifty-three plum varieties with different flesh and skin color for their antioxidant content and AOA. Total phenolics, anthocyanins, and carotenoids were analyzed spectrophotometrically. AOA was evaluated by 2,2-diphenyl-1-picrylhydrazyl (DPPH). Carotenoid content was higher in yellow-flesh (2-3 mg β-carotene/100 g fw-fresh weight) than in white or red-flesh peaches (0.01-1.8 mg β-carotene/100 g fw). AOA was about 2-fold higher in red-flesh varieties than in white/yellow-flesh peach varieties. Among the peaches, the AOA was best correlated with phenolic content. Cavallos et al., (2002) reported the anthocyanin content of the peaches ranged from 7.64 to 50.01 mg cyanidin 3-glucoside/100 g fresh tissue. The total phenolics content for peaches ranged from 99 to 449 mg chlorogenic acid/ 100 g fresh tissue. The anti-oxidant activity ranged from 440 to 1784 ug equivalent Trolox/ g fresh tissue for peaches. Chang et al.,, (2000) reported the highest amount of total phenolic compounds in the flesh, which is the primary portion of the peach consumed. HPLC analysis showed that hydroxycinnamates and flavan-3-ols were significant components of peach extracts. The major flavan-3-ol compounds included procyanidin B1, ranging from 9 to 279 mg/kg, and catechin, ranging from 8 to 434 mg/kg. These two compounds were also found to be more abundant in the peel, as compared to the flesh and whole extracts. Rutin and isoquercetin were the primary flavonol compounds found in clingstone peaches. As with malvin, rutin and isoquercetin were present in low levels in all peach extracts and were found mainly in the peels rather than the flesh.

Pharmocological Evidence for its medicinal properties

Peach could be of great interest as an important antioxidant source including chlorogenic acid, and it may provide health-promoting advantages to consumers by intake of this fruit or by utilization of its peels as antioxidant sources in industry (Simone et al., 2009). Most of the antioxidants present in peaches are polyphenols as mentioned above.

Polyphenolic compounds in the diet enhance the stability of low-density lipoprotein (LDL) to oxidation, and evidence exists that LDL oxidation plays a significant role in atherosclerosis and coronary heart disease (Steinberg et al., 1989). The role of natural antioxidants in fruits and vegetables in the delay of the onset of atherogenesis and pathogenesis has received considerable attention (Steinberg et al., 1989). The phenolic compounds in red wine and grape extracts were shown to be very effective in inhibiting the oxidation of LDL in vitro (Frankel et al., 1993, 1998; Kanner et al., 1994; Teissedre et al., 1996; Meyer et al., 1997). The phenolic compounds in commercial grape juices also were shown to have an antioxidant effect on human LDL (Frankel et al.,, 1998). The phytochemicals by acting as antioxidants bring about the disease prevention through a mechanism related with scavenging of free radicals. In case of cancer prevention, a dietary increase of antioxidant defense capacity has been considered a reasonable way to prevent reactive oxygen species (ROS)-mediated carcinogenicity. Epidemiological and human studies indicate that a lower risk of cancer is related to antioxidant-rich diets (Block et al., 1992.). Noratoo et al., (2009) had shown the peach variety Rich Lady extract effectively inhibited the proliferation of the estrogen-independent MDA-MB-435 breast cancer cell line. They confirmed that phenolic acids present in peach: chlorogenic and neo-chlorogenic acids have potential as chemopreventive dietary compounds because of the relatively high growth inhibition exerted on the estrogen-independent MDA-MB-435 breast cancer cell line and low toxicity exerted in the normal MCF-10A cells.

Health Benefits and Curative Properties of Eating Peach

- Peaches help make the skin healthy and also add color to the complexion.
- It has been seen that consumption of peaches helps in the removal of worms from the intestinal tract.
- Being rich in Vitamin A, peaches might help prevent cancer in organs and glands with epithelial tissue.
- Peaches comprise of more than 80 percent water and are a good source of dietary fiber, making them good for those trying to lose weight.
- Consumption of peaches, on a regular basis, can keep your bowel movements regular and even prevent straining as it contains high amount of fibres.
- Researches have suggested that peaches have good to excellent antioxidant activity, some antimicrobial activity and good to excellent tumor growth inhibition activity.
- Peaches have a small laxative effect and a powerful diuretic effect and thus, are recommended to people suffering from rheumatism and gout.

- Peach flowers have sedative proprieties and are good for children who are restless, especially when boiled in water with sugar and honey.

Peaches have been found to be beneficial for individuals suffering from the following ailments:

- Acidosis
- Anemia
- Asthma
- Bladder and Kidney Stones
- Bronchitis
- Constipation
- Dry Cough
- Gastritis
- High Blood Pressure
- Nephritis
- Poor Digestion

(Source : http://lifestyle.iloveindia.com/lounge/benefits-of-peach-1624.html accessed on 01.04.2011)

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31. PLUMS AND PRUNES (*Prunus domestica* L.)

Mature plum fruit may have a dusty-white coating that gives them a glaucous appearance and is easily rubbed off. This is an epicuticular wax coating and is known as "wax bloom". Dried plum fruits are called **dried plums** or **prunes**, although prunes are a distinct type of plum, and may have pre-dated the fruits now commonly known as plums.

Uses

Plums are mainly used consumed as fresh fruits. They are also used widely for making jam, jelly chutney and squash. Certain varieties of European plum are specially suited for drying to produce prunes. Prunes are firm fleshed fruits of *P.domestica* cultivars having sugar content which can be dried whole without fermentation around the pit, to make a firm tasteful product that can be stored for long period.

Nutritional Composition of plum fruit

Component	**Quantity**	**Component**	**Quantity**
Moisture	86.90 g/100 g	Iron	0.6 mg/100 g
Carbohydrates	11.10 g/100 g	Carotene	166.0 IU/100 g
Protein	0.70 g/100 g	Thiamine	0.04 mg/100 g
Fat	0.50 g/100 g	Riboflavin	0.10 mg/100 g
Fibre	0.40 g/100 g	Niacin	0.3 mg/100g
Mineral	0.40 g/100 g	Nicotinic acid	0.1 mg/100 g
Calcium	10 mg/100 g	Ascorbic acid	5.0 mg/100 g
Phosphorus	12 mg/100 g	Energy	52 Kcal/100 g

(Gopalan, et al., 1985)

Phytochemicals

In human nutrition plums are valued as a rich energetic source with high protective, dietetic and therapeutic value. Fresh fruits have low calorie content and relatively high nutritive value. They can greatly contribute to human nutrition because of their richness in antioxidants. Plums are also a big natural source of phytochemicals such as flavonoids, phenols, anthocyanins and other phythochemicals which have antioxidant capacity and help protect cells against the oxidative damage caused by free radicals (Chun *et al.,* 2003; Stintzing *et al.,* 2002). Donovan et al., (1998) analyzed the phenols of prunes and plums and reported that hydroxycinnamates, especially neochlorogenic acid, and chlorogenic acid predominated, and these compounds, as well as the prune and prune juice extracts, inhibited the oxidation of Loe Density Lipoproteins (LDL). Natakani et al., (2000) reported that neochlorogenic acid (3-CQA) and cryptochlorogenic acid (4-CQA) isomers isolated from prune (*Prunus domestica* L.), exhibited almost similar level of antioxidant activity.

The antioxidative components of prunes are such caffeoylquinic acids as chlorogenic, neochlorogenic, and cryptochlorogenic acids have been shown to possess significant antioxidative activities in tests using the oxygen radical absorbance capacity method (Kayano, 2002). A prune extract was separated by an antioxidant guided assay to obtain an oligomeric proanthocyanidin fraction. The antioxidative oligomer was characterized as a procyanidin oligomer with an average polymerization degree of five and composed of epicatechin and catechin units, which are the other phenols found in prunes. The antioxidative activity of the oligomer showed greater potency than chlorogenic acid component in prunes and plums (Kimura et al.,, 2008). Studies of Kimura et al., (2008) also suggested that the highly antioxidative activity of prunes depends on the effects of both the proanthocyanidin oligomer and caffeoylquinic acids. The bioavailability of proanthocyanidin has been little disclosed to date, although many studies have revealed the protective effect of proanthocyanidins against cardiovascular diseases (Buelga and Scalbert, 2000; Tsang et al.,, 2005). Recently purunusides A-C, new homoisoflavone glucosides, together with the known compounds beta-sitosterol and 6,7-methylenedioxy-8-methoxycoumarin have been isolated from n-butanol and ethyl acetate soluble fractions of *Prunus domestica*. Their structures were assigned on the basis of spectral studies. The purunusides A-C showed potent inhibitory activity against the enzyme alpha-glucosidase (Kosar et al., 2009).

Pharmacological Evidence for its medicinal properties

Epidemiological studies have shown that consumption of foods and beverages rich in phenolic content is correlated with reduced incidences of heart disease (Hertog et al., 1995; Criqui and Ringel, 1994; Renaud and deLorgeril, 1992). One possible

explanation is that phenolic compounds slow the progression of atherosclerosis by acting as antioxidants toward low density lipoproteins (LDL) (Frankel et al., 1993; Kinsella et al., 1993). Marrie et al., (2004) studied the effects of 10 different extracts of fruits and berries on cell proliferation of colon cancer cells HT29 and breast cancer cells MCF-7 and reported that the extracts decreased the proliferation of both colon cancer cells HT29 and breast cancer cells MCF-7, and the effect was concentration dependent. They suggested that the control of proliferation of cancer cells may be due to anthocyanins. Furher to support this theory the anthocyanin-rich extract (ARE) of the fruit of plant native to the Amazon region, showed moderate cytotoxicity toward different cancer cell lines when evaluated by MTT assays (Barrios et al., 2010). Ahmed et al., (2010 b) reported alteration in liver function by use of prunes and concluded that it may have clinical relevance in appropriate cases and prunes might prove beneficial in hepatic diseases. The investigations by Ahmed et al., (2010 a) found that there was significant reduction of blood pressure by consumption of a single dose of prunes daily in a group of volunteers compared to the controls. With the double dose of prunes, only systolic BP was reduced significantly. Control group had significantly increased serum HDL whereas test groups had significantly reduced serum cholesterol and LDL indicating the significance of prunes in reduction of hypertension and heart diseases.

Among nutritional factors, recent observations suggest that dried plum, or prunes (*Prunus domestica L.*) is the most effective fruit in both preventing and reversing bone loss. Animal studies and a 3-month clinical trial conducted in the laboratories have shown that dried plum has positive effects on bone indices. The animal data indicate that dried plum not only protects against but more importantly reverses bone loss in two separate models of osteopenia (Hooshmand and Arjmandi, 2009). Dried plum, as low as 5%, was effective in restoring femoral and tibial bone density in rat models as reported by Deyhim et al (2005).

Oxidative stress is linked to neurodegenerative diseases, cancer, cardiovascular diseases and to some behaviors, such as anxiety and depression. In particular, recent research observed a close relationship between oxidative stress and anxiety. The studies conducted using fruits have shown to reduces several of these diseases. Chlorogenic acid (20 mg/kg) induced a decrease in anxiety-related behaviors suggesting an anxiolytic-like effect of this polyphenol. The anti-anxiety effect was blocked by flumazenil suggesting that anxiety is reduced by activation of the benzodiazepine receptor. In vitro, chlorogenic acid protected granulocytes from oxidative stress. Therefore, it was suggested that prunes and plums rich in chlorogenic acid has an anxiety reducing property (Bouayed et al., 2007; Deyhim et al., 2005).

Health benefits and Curative Properties of Plums (Arjmandi et al.,, 2002; Bu et al.,, 2008; Yingsakmongkon et al., 2008)

- Delicious, fleshy, succulent plums are low in calories and contain no saturated fats; but contain numerous health promoting compounds, minerals and vitamins.

- Certain health benefiting compounds present in the plum fruits, such as dietary fiber, **sorbitol,** and **isatin** are known to help regulate the functioning of the digestive system and thereby used in constipation conditions.

- Fresh plums are an excellent source of **vitamin C**, which is also a powerful natural antioxidant. Consumption of foods rich in vitamin C helps body develop resistance against infectious agents, counter inflammation and scavenge harmful free radicals.

- Fresh plums, especially yellow Mirabelle type, are very good source of **vitamin A** and **beta carotene**. Vitamin A is essential for vision. It is also required for maintaining healthy mucus membranes and skin. Consumption of natural fruits rich in vitamin A known to protect from lung and oral cavity cancers.

- The fruit is also good in health promoting flavonoid poly phenolic antioxidants such as lutein, cryptoxanthin and zeaxanthin in significant amounts. These compounds help act as protective scavengers against oxygen-derived free radicals and reactive oxygen species (ROS) that play a role in aging and various disease process. **zeaxanthin,** an important dietary carotenoid selectively absorbed into the retinal macula lutea where it is thought to provide antioxidant and protective light-filtering functions.

- Plums are rich in minerals like potassium, fluoride and iron. Iron is required for red blood cell formation. Potassium in an important component of cell and body fluids that helps controlling heart rate and blood pressure.

- Rich in B-complex group of vitamins such as niacin, vitamin B-6 and pantothenic acid. These vitamins are acting as cofactors help body metabolize carbohydrates, proteins and fats. They also provide about 5% RDA levels of vitamin K. Vitamin K is essential for many clotting factors function in the blood as well as in bone metabolism and helps reduce Alzheimer's disease in the elderly.

(Source : http://www.nutrition-and-you.com/plums.html accessed on 03.05.2011)

- Since plums are rich in antioxidants, they provide protection from superoxide anion radical and also prevent damage to our neurons and fats that form a part of our cell membranes.

- Consumption of plums helps in the production and absorption of iron in the body, thus leading to better blood circulation, which further leads to the growth of healthy tissues.

- Regular consumption of plums can prevent macular degeneration and any other infection of the eye, in the long run.

- Researchers have found that plums have anti-cancer agents that may help prevent the growth of cancerous cells and tumors in the body.

- Eating plums also reduces chances of contracting a heart disease in the long run. Plums have certain cleansing agents that keep the blood pure and prevent complications of the heart.

- Plums have high content of Vitamin C, which means that they help protect the body against health conditions like asthma, colon cancer, osteoarthritis and rheumatoid arthritis.

- Plum juice concentrate is effective in preventing and reducing human influenza A.

  (Source : http://lifestyle.iloveindia.com/lounge/benefits-of-plums-1918.html accessed on 03.05.2011)

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32. Apricot (*Prunus armeniaca* L.)

The **apricot**, *Prunus armeniaca*, L. is a species of *Prunus*, classified with the plum in the subgenus *Prunus*. The native range is somewhat uncertain due to its extensive prehistoric cultivation.

Uses

It is used in many ways, such as , in the preparation of jam, nectar, beverages, puree, leather, etc. The karnel is a source of cooking oil. Leaves are used as fodder. Oil cake is used as cattle feed. Dried apricot is an important commercial product.

Nutritional composition of Apricot (Fresh)

Component	**Quantity (g)**	**Component**	**Quantity (mg)**
Moisture	85.3 g/100 g	Phosphorus	25 mg/100 g
Protein	1.0 g/100 g	Iron	2.2 mg/100 g
Fat	0.3 g/100 g	Thiamin	0.04 mg/100 g
Fibre	1.1 g/100 g	Riboflavin	0.13 mg/100 g
Carbohydrates	11.6 g/100 g	Niacin	0.6 mg/100 g
Mineral	0.7 g/100 g	Ascorbic acid	6 mg/100 g
Vitamin A	2160 µ /100 g	Energy	53 Kcal/100g
Calcium	20 mg/100 g		

(Gopalan et al., 1985)

Nutritional composition of Apricot (Dried)

Component	**Quantity (g)**	**Component**	**Quantity (mg)**
Moisture	19.4 g/100 g	Phosphorus	70 mg/100 g
Protein	1.60 g/100 g	Iron	4.60 mg/100 g
Fat	0.7 g/100 g	Thiamin	0.22 mg/100 g

Fibre	2.1 g/100 g	Riboflavin	0.13 mg/100 g
Carbohydrates	734 g/100 g	Niacin	2.30 mg/100 g
Mineral	2.80 g/100 g	Ascorbic acid	2 mg/100 g
Vitamin A	58 µ /100 g	Energy	53 Kcal/100g
Calcium	110 mg/100 g		

(Gopalan et al., 1985)

Phytochemicals

Research shows that of any food, apricots possess the highest levels and widest variety of carotenoids. Carotenoids are antioxidants that help prevent heart disease reduce "bad cholesterol" levels and protect against cancer (http://en.wikipedia.org/wiki/Apricot). However, Drogoudi et al., (2008) reported that the total antioxidant capacity was better correlated with the total phenol content (r = 0.954) as compared with the total carotenoid content (r = 0.482). Weak correlations were found between the fruit skin color and the antioxidant contents in flesh tissue. Chlorogenic and neochlorogenic acids, (+)-catechin and (-)-epicatechin, and rutin (or quercetin-3-rutinoside) were the major phenolic compounds in apricots (Radi et al., 1997). In addition to these compounds, other quercetin-3-glycosides and procyanidins have been detected. Ruiz et al., (2005) reported four phenolic compound groups, procyanidins, hydroxycinnamic acid derivatives, flavonols, and anthocyanins, which were identified by HPLC-MS/MS and individually quantified using HPLC-DAD. Chlorogenic and neochlorogenic acids, procyanidins B1, B2, and B4, and some procyanidin trimers, quercetin 3-rutinoside, kaempferol 3-rhamnosyl-hexoside and quercetin 3-acetyl-hexoside, cyanidin 3-rutinoside, and 3-glucoside, were detected and quantified in the skin and flesh of the different cultivars of Apricot. Sochor et al., (2010) evaluated nutritional value expressed as content of total phenolic compounds and antioxidant capacity of new apricot (Prunus armeniaca L.) genotypes. Based on the antioxidant capacity and total polyphenols content, a clump analysis dendrogram of the monitored apricot genotypes was constructed. In addition, they optimized high performance liquid chromatography coupled with tandem electrochemical and spectrometric detection and determined phenolic profile consisting of the following fifteen phenolic compounds: gallic acid, 4-aminobenzoic acid,

chlorogenic acid, ferulic acid, caffeic acid, procatechin, salicylic acid, p-coumaric acid, the flavonols quercetin and quercitrin, the flavonol glycoside rutin, resveratrol, vanillin, and the isomers epicatechin, (-)- and (+)- catechin. Investigations by Rashid et al., (2006) on the chemical constituents of the fruits of *Prunus armeniaca* have led to the isolation of two new flavonoid glycosides, 4',5,7-trihydroxy flavone-7-O-[β-D-mannopyranosyl (1'"→2")]-β-D-allopyranoside (1) and 3,4',5,7-tetrahydroxy-3',5'-di-methoxy flavone 3-O-[α-Lrhamnopyranosyl (1'"→6")]-β-D-galactopyranoside (2), from the butanolic fraction of the fruits. The butanolic extract exhibited antibacterial activity against both Gram positive and Gram negative bacteria.

Pharmcological Evidence

Various flavonoids have been reported from Prunus species (Masao,1957; Nagarajan and Seshadri, 1964). Different parts of the apricot plants are used for the treatment of many ailments, mainly against diseases of bacterial and fungal origins (Yi it et al., 2009). In the Yunani system of medicine, it is used as an antidiarrohetic, emetic and anthelmintic in lever diseases, piles, earache and deafness, and as an expectorant remedy for dry throat, laryngitis, lung diseases and abscesses (Kritikar and Basu, 1988). It is also regarded as a bechic, depurative sedative for the respiratory centre, a tonic and antispasmodic, as well as a remedy for severe colds and bronchial asthma (Perry and Judith, 1980).

Exposure to low x-ray doses damages the spermatozoa, mainly by late-onset (ie, after 3 months) oxidative stress. Antioxidants ameliorate oxidation and prevent tissue damage. *Prunus armeniaca* L (apricot), rich in carotenoids and vitamins, is a potent natural antioxidant. Ugras et al., (2010) demonstrated that in mice, the natural antioxidant activity of apricot ameliorates the delayed detrimental effects of low-dose irradiation on testis tissue. Kurus et al., (2009) also proved that apricot rich diet may have a preventive role on histopathological changes caused by alcohol in rat testes.

Oztruk et al., (2009) investigated the protective effect of 10 % and 20 % apricot-containing feed on carbon tetrachloride (CCl4)-induced hepatic steatosis and damage in rats and concluded that apricot feeding had beneficial effects on CCl4-induced liver steatosis and damage probably due to its antioxidant nutrient (beta-carotene and vitamin) contents and high radical-scavenging capacity. They opined that dietary intake of apricot can reduce the risk of liver steatosis and damage caused by free radicals.

Based on the studies of Yu et al., (2009) major polyphenol compounds like (-)-epicatechin and (-)-gallocatechin gallate, were found to have anti-cancer properties. On the basis of their results, the fruits having active compound, (-)-epicatechin, are reported to be a natural resource for developing novel therapeutic agents for cancer prevention and treatment.

Noratto et al., (2009) confirmed that phenolic acids like chlorogenic and neo-chlorogenic acids found abundantly in prunus group have potential as chemopreventive dietary compounds because of the relatively high growth inhibition exerted on the estrogen-independent MDA-MB-435 breast cancer cell line and low toxicity exerted in the normal MCF-10A cells.

Aromatase is a cytochrome P450 enzyme (CYP19) and is the rate limiting enzyme in the conversion of androgens to estrogens. Suppression of in situ estrogen production through aromatase inhibition is the current treatment strategy for hormone-responsive breast cancers. Drugs that inhibit aromatase have been developed and are currently utilized as adjuvant therapy for breast cancer in post-menopausal women with hormone dependent breast cancer. Natural compounds have been studied extensively for important biologic effects such as antioxidant, anti-tumor and anti-viral effects. A significant number of studies have also investigated the aromatase inhibitory properties of a variety of plant extracts and phytochemicals including fruits and vegetables. The identification of natural compounds that inhibit aromatase could be useful both from a chemopreventive standpoint and in the development of new aromatase inhibitory drugs (Adams and Chen, 2009). Apricots also contains several phenolic compounds found in peaches and plums. The study of Lea et al., (2008) have proved the inhibitory effect of these phenolic components on colon cancer cells.

Okada et al., (2007) reported that MK615 is an anti-cancer substance extracted from the Japanese apricot and their studies indicated that MK615 has an anti-cancer effect against hepatocellular carcinoma (HCC) evaluated in vitro, and its mechanism was elucidated, where its effect was reported to be exerted through inhibition of Aurora A activity. Okada et al., (2008) reported that MK615 also inhibits pancreatic cancer cell growth by dual inhibition of Aurora A and B kinases.

An active compound B-1, that inhibits cancer cells was isolated from the fruit of *Prunus mume*, and its structure and in vitro activities were characterized by Jeong et al., (2006). The molecular formula of B-1 was C19H22O6 {2-hydroxy-1-[(7-hydroxy-2-oxo-2H-chromen-6-yl)methyl]-2-methylpropyl-(2Z)-3-methyl-but-e-enoate:prunate}. It has a highly specific inhibitory effect against cancer cells but little effect against normal cells. When the cancer cell lines Hep-2 and SK-OV-3 were incubated with B-1 for 72 h, most of the tested cells suffered strong growth inhibition. The compound has the potential to be developed as a nutraceutical.

Helicobacter pylori (Hp) infection is an important factor in human gastric disorders, including chronic active gastritis, peptic ulcers, intestinal metaplasia and cancer. Since epidemiologic studies overwhelmingly agree on a protective influence of fruits and vegetables in reducing the risk of gastric neoplasia and processed foods made from *Prunus mume* Sieb. et Zucc. (Japanese apricot or "Ume" in Japanese) are traditionally known for their miscellaneous medical effects. Otsuka et al., (2005) investigated the efficacy of a fruit-juice concentrate of Japanese apricot (CJA) in the glandular stomach of Hp-infected Mongolian gerbils. Their findings suggest that

suppressive effects on gastric cancer development might also be expected as a result of decreased numbers of Hp and improvement of Hp-induced chronic active gastritis on administration of CJA.

Health Benefits and Curative Properties

- Apricot is an excellent source of minerals like calcium, phosphorus, iron and traces of sodium, sulphur, manganese, cobalt and bromine.

- The beta-carotene and lycopene in this golden fruit helps protect the LDL cholesterol from oxidation, which in turn helps prevent heart disease.

- Due to their high fiber to volume ratio, dried apricots are sometimes used to relieve constipation or induce diarrhea. Effects can be felt after eating as few as three.

- The fruit, kernel (inner softer part of the seed), oil and flowers of the apricot have always been used in medicine and medical treatment from ancient days.

- The kernel yields an oil that is similar to that of the almond and is widely used for their sedative, anti-spasmodic relief to strained muscles. It is also useful for healing of wounds, expelling worms and as a general health tonic.

- **Anemia:** The high content of iron in apricot makes it an excellent food for anemia sufferers. The small but essential amount of copper in the fruit makes the iron available to the body. Liberal consumption of apricot can increase the production of hemoglobin in the body. This is ideal for women after their menstrual cycle, especially those with heavy flow.

- **Constipation:** The cellulose and pectin content in apricot is a gentle laxative and are effective in the treatment of constipation. The insoluble cellulose acts as a roughage which helps the bowel movement. The pectin absorbs and retains water, thereby increasing bulk to stools, aiding in smooth bowel movement.

- **Digestion:** Take an apricot before meal to aid digestion, as it has an alkaline reaction in the digestive system.

- **Eyes/Vision:** The high amount of vitamin A (especially when dried) is essential to maintain or improve eyesight. Insufficiency of this vitamin can cause night blindness and impair sight.

- **Fever:** Blend some honey and apricots with some mineral water and drink to cool down fevers. It quenches the thirst and effectively eliminates the waste products from the body.

- **Skin Problem:** Juice fresh apricot leaves and apply on scabies, eczema, sun-burn or skin itchiness, for that cool, soothing feeling.

(Source : http://www.juicing-for-health.com/apricot.html)

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33. Strawberry (*Fragaria* × *ananassa.* Duch)

Fragaria- is a genus of flowering plants in the rose family, Rosaceae, commonly known as **strawberries** for their edible fruits. Originally straw was used as a mulch in cultivating the plants. There are more than 20 described species and many hybrids and cultivars. The most common strawberries grown commercially are cultivars of the garden strawberry, a hybrid known as *Fragaria* × *ananassa*. Strawberries have a taste that varies by cultivar, and ranges from quite sweet to rather tart. Strawberries are an important commercial fruit crop, widely grown in all temperate regions of the world.

Uses

Strawberries are esteemed as dessert, because of its excellent taste and flavour. It may be into preserves, jam jelly, syrup or juice; it may be canned also. strawberry sliced or whole, can be frozen. Strawberry wine is prepared by adding sugars to crushed fruit or juice

Nutritional Composition of strawberry

Component	**Quantity**	**Component**	**Quantity**
Moisture	87.80 g/100 g	Phosphorus	30 mg/100 g
Carbohydrates	9.80 g/100 g	Potassium	160 mg/100 g
Fat	0.20 g/100 g	Iron	1.80 mg/100 g
Protein	0.70 g/100 g	Vitamin C	52 mg/100 g
Fibre	1.10 g/100 g	Niacin	0.20 mg/100 g
Calcium	30 mg/100 g	Riboflavin	0.20 mg/100 g

(Gopalan et al., 1985)

Phytochemicals

Popularly consumed berries include blackberries, black raspberries, blueberries, cranberries, raspberries and strawberries. It is useful to briefly reflect on berry phytochemicals and our understanding of how their chemistry influences their biological and physiological functions. Although many berry fruits contain micro and macro nutrients including vitamins, minerals, folate, and fiber, their various biological properties have been largely related to their high levels and wide diversity of phenolic-

type phytochemicals. It is noteworthy that both lipophilic (minor) and hydrophilic (major) phytochemicals are found in berries, but it is the latter class that has been largely implicated in the bioactivities of these fruits. However, the complementary, additive, and/or synergistic effects resulting from multiple phytochemicals found in berry fruits are believed to be responsible for their wide range of observed biological properties rather than these effects being due to a single constituent alone.Berry phenolics include flavonoids (anthocyanins, flavonols, and flavanols), tannins [condensed tannins (proanthocyanidins) and hydrolyzable tannins (ellagitannins and gallotannins)], stilbenoids, and phenolic acids (Seeram, 2006). Among berry phenolics, the anthocyanins (pigments that account for their attractive colors), are best studied and have a wide range of bioactivities including antioxidant, anticancer, and anti-inflammatory properties (Seeram et al., 2003; Seeram and Nair, 2002; Seeram et al., 2001; Seeram 2008).

da Silva et al., (2007) investigated the anthocyanins in strawberry and reported twenty-five anthocyanin pigments, most of them containing Pelargonidin (Pg) as aglycone; some cyanidin (Cy) derivatives. Glucose and rutinose were the usual substituting sugars, although arabinose and rhamnose were also tentatively identified; some minor anthocyanins showed acylation with aliphatic acids. A relevant aspect in his study was the detection of anthocyanin-derived pigments, namely 5-carboxypyranopelargonidin-3-glucoside and four condensed pigments containing C–C linked anthocyanin (Pg) and flavanol (catechin and afzelechin) residues. Total anthocyanin content ranged between 200 and 600 mg kg^{-1}, with Pg 3-gluc constituting 77–90% of the anthocyanins in the strawberry extracts followed by Pg 3-rut (6–11%) and Cy 3-gluc (3–10%). A notable variability was repoted among the anthocyanin concentrations in samples of a same variety and harvest, indicating a strongly influence of the degree of maturity, edaphic-climatic factors and post-harvest storage.

The major classes of berry phenolics were anthocyanins, flavonols, flavanols, ellagitannins, gallotannins, proanthocyanidins, and phenolic acids (Seeram et al., 2006). In strawberries, the most abundant of these phytochemcials are ellagic acid, and certain flavonoids: anthocyanin, catechin, quercetin and kaempferol (Hunnum, 2004). Zhang et al., (2008) isolated 10 phenolics compounds from strawberry . These were cyanidin-3-glucoside (**1**), pelargonidin (**2**), pelargonidin-3-glucoside (**3**), pelargonidin-3-rutinoside (**4**), kaempferol (**5**), quercetin (**6**), kaempferol-3-(6′-coumaroyl)glucoside) (**7**), 3,4,5-trihydroxyphenyl-acrylic acid (**8**), glucose ester of (*E*)-*p*-coumaric acid (**9**), and ellagic acid (Seeram , 2006).

Pharmacological Evidence

In fact, a large and growing body of evidence shows that berry phytochemicals regulate the activities of metabolizing enzymes; modulate nuclear receptors, gene expression, and subcellular signaling pathways; and repair DNA oxidative damage, etc. (Seeram and Heber, 2006; Seeram, 2006). The inflammatory response initiated by acetic

acid includes activation of cyclooxygenase and lipooxygenase pathways (Sharon and Stenson, 1985; Macpherson and Pfeiffer, 1976).Fruits of *F. vesca* have been found to contain salicylic acid (Phillips et al.,, 1990.) which is a known anti-inflammatory agent that acts by inhibiting cyclooxygenase enzyme. Therefore, this might be its probable mechanism of anti-inflammatory action. Also, flavonoids found in the *F. vesca* plant (Agrawal and Paridhavi , 2007) possess anti-proliferative activity that causes a decrease in the weight and volume of contents of granuloma in inflammation (Koganov et al.,, 1999). Studies of Naemura et al., (2005) in Strawberry varieties KYSt-4 (Nohime), KYSt-11 (Kurume IH-1) and KYSt-17 (Kurume 58) showed significant antiplatelet activity both in vitro and, after oral administration, in vivo. The dual mechanism of the effect may involve a direct inhibition of both platelet function and antioxidant activities.

The overall relative neuronal cell protective activity of three fruits by three tests followed the decreasing order strawberry > banana > orange. The protective effects appeared to be due to the higher phenolic contents including anthocyanins, and anthocyanins in strawberries seemed to be the major contributors (Heo and Lee, 2005).

A comparison among ellagic acid, purified ellagitannins, and a strawberry extract was done to evaluate the possible synergistic effects of phenolics. In relation to the antiproliferative activity, it was observed that ellagic acid had the highest percentage inhibition of cell proliferation. The strawberry extract had lower efficacy in inhibiting the cell proliferation, indicating that in the case of this fruit there is no synergism. Purified ellagitannins had high α-amylase and ACE inhibitory activities. However, these compounds had low α-glucosidase inhibitory activity. These results suggested that the ellagitannins and ellagic acid have good potential for the management of hyperglycemia and hypertension linked to type 2 diabetes. However, further studies with animal and human models are needed to advance the in vitro assay-based biochemical rationale from this study (Pinto et al.,, 2010).

Basu et al., (2010) reported that short-term freeze-dried strawberry supplementation improved selected atherosclerotic risk factors, including dyslipidemia and circulating adhesion molecules in subjects with metabolic syndrome.

In case of liver cancer, the proliferation of $HepG_2$ human liver cancer cells was significantly inhibited in a dose-dependent manner after exposure to several strawberry cultivar extracts. No relationship was found between antiproliferative activity and antioxidant content (Meyers et al., 2003).

Health Benefits of Strawberries

Nutrients in Strawberries

Strawberries are an excellent source of dietary fiber and Vitamins C and K. They are a very good source of manganese, pantothenic acid, vitamin B1, and iodine. They are a good source of folic acid, biotin, and vitamin B6. Strawberries contain **high levels of antioxidants**, which can decrease the risk of chronic disease.

A comprehensive breakdown of protein, carbohydrate, fat, vitamin and mineral content presented in an easy to read pie chart can be found in our Nutrition Database where this food can also be added to a meal planner.

Cancer Prevention

Ellagic acid is present in many red fruits and berries, including raspberries, strawberries, blackberries and cranberries. Studies have shown that strawberry consumption can increase anti-cancer activity on cancer cells of the breast, oesophagus, skin, colon, prostate and pancreas. More specifically, ellagic acid prevents the destruction of P53 gene by cancer cells. Ellagic acid can also bind with cancer causing molecules, thereby making them inactive. Strawberries have also been shown to significantly reduce liver cancer cells.

Alzheimer's Disease Prevention

In addition to their known beneficial effects on cancer and heart disease, the antioxidant qualities of strawberries may also be beneficial in **reversing the course of neuronal and behavioural aging.** Due to their positive effects against anti-neurodegenerative diseases, strawberries are helpful in **slowing the onset and reduce the effects of Alzheimer's disease.**

Cardiovascular Health

Strawberries have also been linked with effecting blood vessels, platelets and lipoproteins positively, which can **reduce the risk of coronary heart diseases.**

Anti Inflammatory

Strawberry extracts have also been shown to inhibit COX enzymes in vitro, which **inhibits the inflammatory process.**

Glycemic Index (GI) of Strawberries

In a study to determine the estimated GI of various foods, it was concluded that strawberries have a **low GI of 40.**
(Source : http://www.elements4health.com/strawberries.html)

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34. AVACADO (*Persea americana* Mill)

The avocado (*Persea Americana* **Mill**) belonging to the family Lauraceae, may have originated in southern Mexico but was cultivated from the Rio Grande to central Peru long before the arrival of Europeans. Thereafter, it was carried not only to the West Indies (where it was first reported in Jamaica in 1696), but to nearly all parts of the tropical and subtropical world with suitable environmental conditions. It reached India in 1892 and is grown especially around Madras and Bangalore but has not become very popular because of Indian's preference for sweet fruits. (Morton, 1987).

Uses

As the sugar content is low, this fruit can be highly recommended as a high energy food for diabetics. The pulp of the fruit can be preserved by freezing, and can be used as sandwich filling or spread, in ice creams and milk shakes. Though the fruit is high in fat content, it is harmless unlike animal fat. The pulp has butter consistency, looks very much like cow's butter and bland in taste with a nutty flavour, without any offensive odour or smell, infact has pleasant aroma as of the tender coconut.

Nutritional Composition of Avacado

Component	**Quantity**	**Component**	**Quantity**
Carbohydrate	5.1 g/100 g	Calcium	10.0 mg/100 g
Protein	1.7 g/100 g	Chlorine	11.0 mg/100 g
Fat	26.4 g/100 g	Iron	0.60 mg/100 g
Crude fibre	1.8 g/100 g	Phosphorous	38.00 mg/100 g
Vitamin A	0.17 mg/100 g	Potassium	368.00 mg/100 g
Ascorbic acid	16.00 mg/100 g	Sodium	3.00 mg/100 g
Niacin	1.10 mg/100 g	Sulphur	28.50 mg/100 g
Riboflavin	0.13 mg/100 g	Magnesium	35.00 mg/100 g
Thiamine	0.06 mg/100 g	Copper	0.45 mg/100 g

(Bose and Mitra, 1990)

Phytochemicals

Avocado (*Persea americana*) is an important tropical fruit, but little is known about their antioxidant capacities and phytochemical composition. Wang et al., (2010) reported that avocado seeds contained the highest antioxidant capacities, phenolic content, and procyanidins, whereas the pulp had the lowest. Procyanidins, including catechin, epicatechin, A- and B-type dimers, A- and B-type trimers, tetramers, pentamers and hexamers, were identified in peels and seeds using normal-phase HPLC–ESI-MS^n. Antioxidant capacities, phenolic contents and procyanidins in avocados were highly correlated, suggesting that procyanidins were the major phenolic compounds that contributed to antioxidant capacities. Carotenoids and chlorophylls were found to be concentrated in avocado peels but did not correlate with antioxidant capacities. Their study suggested that avocado seeds and peels, industrial wastes of avocado processing, can be exploited as source of antioxidants. Lu et al., (2010) have confirmed the presence of lutein (**7**), zeaxanthin (**8**), β-cryptoxanthin (**9**), α-carotene (**10**), and β-carotene (**11**) in the California Hass avocado. They also identified the following carotenoids all-trans neoxanthin (**1**), all-trans violaxanthin (**2**), all-trans neochrome (**3**), 9′-cis-neoxanthin (**4**), lutein-5, 6 epoxide (**5**), and chrysanthemaxanthin (**6**). Percin is a phytochemical reported in avocado having antiproliferating effect against breast cancer cell (Butt et al.,, 2006). Avocado and soybean oils contain a class of biologically active compounds classified as unsaponifiable lipids [avocado/ soy unsaponifiables (ASU)] (Zorn, 1981). The major components of ASU by weight are the phytosterols beta-sitosterol, campesterol and stigmasterol.

Pharmacological Evidence of medicinal properties of avocado

Phytosterols in general, and betasitosterol in particular, are now considered potent anti-inflammatory agents with antioxidant and analgesic activity (Bouice, 2001; De Jong et al., 2003; Gupta et al., 1980). Antioxidant (AO) systems are present in cells to guard cellular structures against naturally occurring, extremely reactive compounds (particularly ROS) such as the oxygen ions, the hydroxyl radical and other free radicals as well as hydrogen peroxide. Such compounds, which form as natural by-products of the normal oxygen metabolism, could, due to their high chemical reactivity, damage proteins, DNA and lipids – a damage which would eventually lead to cell death. The removal of such compounds from cells is afforded either by ROS scavenging enzymes (e.g. superoxide dismutase, ascorbate peroxidase and catalase) which will inactivate the ROS or by small scavenging molecules (e.g. ascorbic acid, glutathione, polyphenols) which combine with the ROS to form non-toxic compounds. ROS commonly occurring in plant tissue are the superoxide anion, which is scavenged by superoxide dismutase (SOD), as well as hydrogen peroxide, which is scavenged by catalase and ascorbate peroxidase, and using the ascorbate-glutathione cycle. Hydroxyl radicals and singlet oxygen are scavenged nonenzymatically by compounds such as carotenoids, ascorbate and α-tocopherol (Bertling et al., 2007). The findings of a study conducted by Ojewole et al., (2007) suggested that *P americana* leaf could be used as a natural supplementary remedy

in essential hypertension and certain cases of cardiac dysfunctions in some rural Africa communities.

Health benefits and Curative Properties of Avocado

Prostate Cancer Prevention

Avocados have been shown to inhibit the growth of prostate cancer.

OralCancerDefense

Research has shown that certain compounds in avocados are able to seek out pre-cancerous and cancerous oral cancer cells and destroy them without harming healthy cells.

Breast Cancer Protection

Avocado, like olive oil, is high in oleic acid, which has been shown to prevent breast cancer in numerous studies.

Eye Health

Avocados have more of the carotenoid lutein than any other commonly consumed fruit. Lutein protects against macular degeneration and cataracts, two disabling age-related eye diseases.

Lower Cholesterol

Avocados are high in beta-sitosterol, a compound that has been shown to lower cholesterol levels. In one study, 45 volunteers experienced an average drop in cholesterol of 17% after eating avocados for only one week.

Heart Health

One cup of avocado has 23% of the recommended daily value of folate. Studies show that people who eat diets rich in folate have a much lower incidence of heart disease than those who don't. The vitamin E, monounsaturated fats, and glutathione in avocado are also great for your heart.

Stroke Prevention

The high levels of folate in avocado are also protective against strokes. People who eat diets rich in folate have a much lower risk of stroke than those who don't.

Better Nutrient Absorption

Research has found that certain nutrients are absorbed better when eaten with avocado. In one study, when participants ate a salad containing avocados, they absorbed five times the amount of carotenoids (a group of nutrients that includes lycopene and beta carotene) than those who didn't include avocados.

Glutathione Source

Avocados are an excellent source of glutathione, an important antioxidant that researchers say is important in preventing aging, cancer, and heart disease.

Vitamin E Powerhouse

Avocados are the best fruit source of vitamin E, an essential vitamin that protects against many diseases and helps maintains overall health.

(Source : http://www.healthdiaries.com/eatthis/10-health-benefits-of-avocados.html)

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35. RAMBUTAN (*Nephelium lappaceum* L.)

The rambutan is native to Malaysia and commonly cultivated throughout the archipelago and southeast Asia. Though a close relative of the lychee and an equally desirable fruit, this member of the Sapindaceae is not nearly as well-known. Botanically, it is *Nephelium lappaceum* L. (syns. *Euphoria nephelium* DC.; *Dimocarpus crinita* Lour.). In the vernacular, it is generally called rambutan (in French, *ramboutan* or *ramboutanier;* in Dutch, *ramboetan);* occasionally in India, *ramboostan.* To the Chinese it is *shao tzu,* to Vietnamese, *chom chom* or *vai thieu;* to Kampucheans, *ser mon,* or *chle sao mao.* There are other local names in the various dialects of southeast Asia and the East Indies.

Nutritional Composition in Rambutan:

Component	**Quantity**	**Component**	**Quantity**
Moisture	83 g/100 g	Iron	1.8 mg/100 g
Protein	0.9 g/100 g	Vitamin A	41 IU/100 g
Fat	0.1 g /100 g	Thiamine B_1	0.4 mg/100 g
Carbohydrate	14.5 g /100g	Riboflavin B_2	0.05 mg/100 g
Fibre	1.1 g/100 g	Calcium	3 mg /100 g
Niacin B_5	0.6 mg/100 g	Phosphorous	6 mg/100 g
Vitamin C	31 mg/100 g		

(Bose and Mitra, 1990)

Uses of Rambutan

Rambutan is a juicy fruit and it is very popular and tasty fruit in many countries. Rambutan mainly serve as fresh fruit or a dessert mixed with other fruits or used for canning or made into fruit syrup. The oil of its seed is used for soap making. The root have some medicinal value, tannin present in it is used for dyes. The whole tree with its beautiful leaves, colorful fruits and flowers serves as an ornamental tree in land scape.

Seed oil from the Rambutan is used to manufacture candles and soap. Although Rambutan trees are not cut down often its wood is used in the construction industry. Rambutan fruit is said to heal dysentery and diarrhea effectively. This fruit leaves are also used as cataplasm to cure headaches. In Malaysia, Rambutan fruit skin is used to prepare native medicines. Further, Rambutan trees roots are boiled and used as a medication to cure fever. Cultivated for its fresh fruit, it is also made as syrup and cooked for stewed

fruit and jams. The colorful fruits are regularly used in displays with flower and fruit arrangements. Young shoots are used to produce a green color on silk that is first dyed yellow with turmeric. The fruit dye is one of the ingredients to dye silk a black color. The seeds are edible when roasted, they are bitter and said to be narcotic.

(Source: http://www.fruitsinfo.com/Rambutan-fruit.php)

Phytochemicals

Rambutan fruit contains carbohydrate, protein, fat, phosphorus, iron, calcium and vitamin C. Skin tanin and fruits contain saponin. The seeds contain fat and polyphenols. The leaves contain tannin and saponin. Skin stem contains tannin, saponin, flavonoids, pectic substances, and iron (http://thebest-healthy-foods.com/rambutan-fruit).

Ether, methanolic and aqueous extracts of lyophilized rambutan (*Nephelium lappaceum L.*) peels and seeds were evaluated for phenolic contents, antioxidant and antibacterial activities by Thitilertdecha et al., (2008). High amounts of phenolic compounds were found in the peel extracts and the highest content was in the methanolic fraction. Several potential antioxidant activities, including reducing power, b-carotene bleaching, linoleic peroxidation and free radical scavenging activity, were evaluated. The peel extracts exhibited higher antioxidant activity than the seed extracts in all methods determined. The methanolic fraction was found to be the most active antioxidant. This fraction exhibited greater DPPH- radical scavenging activity than BHT and ascorbic acid.

Many tropical fruit appear to be good sources of ascorbic acid (vitamin C), provitamin A, Mg, and K. Rambutan is also a relatively good source of ascorbic acid, vitamin A and phosphorus. Study conducted by Palanisamy et al., (2008) for the first time revealed the high phenolic content, low pro-oxidant capacity and strong antioxidant activity of the extract from rind of *Nephelium lappaceum*.

Thitilertdecha et al., (2010) conducted **e**xperiments on the isolation and identification of the active constituents in rambutan, and on their antioxidant activity using a lipid peroxidation inhibition assay. The methanolic extract of *N. lappaceum* peels exhibited strong antioxidant properties. Sephadex LH-20 chromatography was utilized in the isolation of each constituent. The isolated compounds were identified as ellagic acid (EA) (**1**), corilagin (**2**) and geraniin (**3**). These compounds accounted for 69.3% of methanolic extract, with geraniin (56.8%) as the major component, and exhibited much greater antioxidant activities than BHT in both lipid peroxidation (77-186 fold) and DPPH• (42-87 fold) assays.

Many fruits belonging to Sapindaceae family have considerable amount of saponins. Activity-guided fractionation of the bark of *Nephelium maingayi*, collected in

Indonesia, led to the isolation of six new saponins (**1**−**6**). The aglycon of **4** was determined to be a new compound, 7α-methoxyerythrodiol, and those of **1**−**3** and of **5** and **6** were identified as erythrodiol and maniladiol (16β-hydroxyamyrin), respectively. The structures of **1**−**6** were determined on the basis of spectral data interpretation, and the absolute configurations of their component monosaccharides were determined as their thiazolidine derivatives after acid hydrolysis.

Pharmacological Evidence for the medicinal properties of Rambutan

Though not much of scientific experiments have been reported on medicinal properties of Rambutan, the basic nutrient components present in the fruit and antioxdiants in peel and seed are belived to provide some health benefits. The aqueous extract of Rambutan peels and seeds were found to exhibit antibacterial activity against eight bacterial strains as assessed by disc diffusion and broth macrodilution methods. All peel extracts exhibited antibacterial activity against five pathogenic bacteria. The most sensitive strain, *Staphylococcus epidermidis*, was inhibited by the methanolic extract (Thitilertdecha et al.,, 2008). Some of the saponins isolated from *Nephelium sp.* were reported to have strong cytotoxic effect against human tumor cell lines (Ito et al.,, 2004.)

Health Benefits and Curative Properties

- Reduce body fat
- Make face skin softer
- Hair care
- Treat dysentery
- Treat diabetes
- Cure fever

(Source : http://thebest-healthy-foods.com/rambutan-fruit/)

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36. PHALSA (*Grewia subinaequalis* DC.)

Phalsa belongs to the family Tiliaceae where only one genus, *Grewia*, yields edible fruit. The only species of any importance is *G. subinaequalis* DC. (syns. *G. asiatica* Mast), long referred to in literature as *G. asiatica* L. Phalsa is the most used vernacular name in India where there are a number of dialectal names. The plant is called *falsa* in Pakistan.

Uses (Morton, 1987; Shankar, 1985**)**

Fruit : The fruits are eaten fresh as dessert, are made into syrup, and extensively employed in the manufacture of soft drinks. The friut is used in making juice and squash. The juice ferments so readily that sodium benzoate must be added as a preservative.

Shoots : The shoots of the plants after pruning can be utilized for making baskets or supporting vegetable crops. Pruning of one full-grown plant is sufficient for making one large or two small baskets. Palsa baskets are fairly strong and can be used for transporting fruits and vegetables. Ropes can also be made from the bark after treating it, which yields fibre.

Leaves: The fresh leaves are valued as fodder.

Bark: The bark is used as a soap substitute in Burma. A mucilaginous extract of the bark is useful in clarifying sugar. Fiber extracted from the bark is made into rope.

Wood: The wood is yellow-white, fine-grained, strong and flexible. It is used for archers' bows, spear handles, shingles and poles for carrying loads on the shoulders. Stems that are pruned off serve as garden poles and for basket-making.

Medicinal Uses: The fruit is astringent and stomachic. When unripe, it alleviates inflammation and is administered in respiratory, cardiac and blood disorders, as well as in fever. An infusion of the bark is given as a demulcent, febrifuge and treatment for diarrhea. The root bark is employed in treating rheumatism. The leaves are applied on skin eruptions and they are known to have antibiotic action.

Nutritional Composition in Phalsa

Constiuent	**Quantity**	**Constituent**	**Quantity**
Moisture	80.80 g/100 g	Phosphorus	39 mg/100 g
Carbohydrates	14.70 g/100 g	Calcium	129 mg/100 g
Proteins	1.30 g/100 g	Iron	3.1 mg/100 g
Fats	0.90 g/100 g	Niacin	0.3 mg/100 g
Fibre	1.20 g/100 g	Vitamin C	22 mg/100 g

(Gopalan et al., 1985)

Phytochemicals

The flowers have been found to contain grewinol, a long chain keto alcohol, tetratricontane-22-ol-13-one. The seeds contain 5% of a bright-yellow oil containing 8.3% palmitic acid, 11.0% stearic acid, 13.4% oleic acid, 64.5% linoleic acid; 2.8% unsaponifiable (Morton, 1987). *Grewia asiatica* fruit (GAE) contains anthocyanin-type cyanidin 3-glucoside, vitamins C and A, minerals, carotenes and dietary fibre (Sharma and Sisodia, 2009). Siddiqi et al., (2011) in an investigation separated crude methanolic extracts from *Grewia asiatica*, *Eugenia jambolana* and *Carissa carandas* s into four major fractions viz. phenolic acids, flavanols, flavonols and anthocyanins which were then analysed for their total phenolic, flavonoid contents, and antimicrobial effects. In addition, anthocyanin fraction was also analysed for total anthocyanins, total colour and polymeric pigments. All fractions showed significant antibacterial activity except anthocyanin. Being the most active, phenolic acid fractions were also tested for their antifungal activity, the fractions of *C. carandas* and *G. asiatica* substantially inhibited all the tested fungal species..

Pharmacological Evidence

Gupta et al., (2010) proved that the antipyretic effect of certain ayurvedic preparations containing several plant products including *Grewia asiatica, L*. for reducing the fever contained flavonoids, specifically glycosidic flavonoids and tannins which had antipyretic property. Detailed analysis of these compounds revealed the presence of at least one active compound, which is structurally quite similar to Aspirin. Gond and Khadabad (2008) reported that there was significan reversal of biochemicals, histological and functional changes induced by rifampicin treatment in rats by petroleum ether extract treatment, indicating promising hepatoprotective activity.

The best-described property of almost every group of flavonoids is their capacity to act as antioxidants. The mechanisms and the sequence of events by which free radicals interfere with cellular functions are not fully understood, but one of the most important events seems to be lipid peroxidation, which results in cellular membrane damage. This cellular damage causes a shift in the net charge of the cell, changing the osmotic pressure, leading to swelling and eventually cell death. Free radicals can attract various inflammatory mediators, contributing to a general inflammatory response and tissue damage. To protect themselves from reactive oxygen species, living organisms have developed several effective mechanisms (10). The antioxidant-defense mechanisms of the body include enzymes such as superoxide dismutase, catalase, and glutatione peroxidase, but also nonenzymatic counterparts such as glutathione, ascorbic acid, and ά- tocopherol (Halliwell, 1995).

The radioprotective effect of *Grewia asiatica* fruit (GAE) which contains anthocyanin-type cyanidin 3-glucoside, vitamins C and A, minerals, carotenes and dietary fibre was studied by Sharma et al., (2009). For the study Swiss albino mice were divided into five groups: (1) control (vehicle treated); (2) GAE treated (700 mg kg^{-1} day^{-1} for 15 days); (3) irradiated (5 Gy); (4) GAE+irradiated and (5) irradiated+GAE treated. The irradiation of animals resulted in a significant elevation of lipid peroxidation in terms of thiobarbituric acid reactive substances (TBARS) content and depletion in glutathione (GSH) and protein levels at all intervals studied, namely 1–30 days, in comparison to the control group. Treatment of mice with GAE before and after irradiation caused a significant depletion in TBARS content followed by a significant elevation in GSH and protein concentration in the intestine and testis of mice at all post-irradiation autopsy intervals in comparison to irradiated mice. Significant protection of DNA and RNA in testis was also noticed. GAE was found to have strong radical scavenging activity in 2,2-diphenyl-1-picrylhydrazyl ($DPPH^*$) and O_2^- assays and also showed *in vitro* radioprotective activity in protein carbonyl assay in a dose-dependent manner. The above results prove the radioprotective efficacy of GAE.

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37. FIG (*Ficus carica* Linn)

Ficus carica L, one of the oldest plant species in China, is abound in Shandong, Xinjiang, Jiangsu province and so on. Its fruits are delicious and can be eaten by human. Its leaves are commonly used to cure hemorrhoid and clear away heart ache (Chinese Medical Dictionary, 1986) .Furthermore, it has also been shown to possess anti-hypertension and anti-cancer effects (Yin et al., 1997 and 1998).

Figs are one of the highest plant sources of calcium and fiber. According to USDA data for the Mission variety, dried figs are richest in fiber, copper, manganese, magnesium, potassium, calcium, and vitamin K, relative to human needs. They have smaller amounts of many other nutrients. Figs have a laxative effect and contain many antioxidants. They are good source of flavonoids and polyphenols (Veberic et al., 2008) including gallic acid, chlorogenic acid, syringic acid, (+)-catechin, (−)-epicatechin and rutin. (http://en.wikipedia.org/wiki/ Common_fig). Fig is an ideal functional food to correct various forms of nutrient deficiencies (Joe, 1999).

Uses

Fig is used in various medicinal properties such as by application for boils and other skin infections. Its latex s used to coagulate milk. The fruit fresh, or dried is valued for its laxative property. Dried and ground fig can be used as a substitute for coffee. Fig is consumed fresh or dried,preserved,candied or canned. Fresh figs are very delicious, wholesoms and nutritious and used as dessert or for making jam.

Nutritional Composition of Fig

Component	Quantity	Component	Quantity
Moisture	88.1 g/100 g	Calcium	80 mg/100 g
Carbohydrates	7.60 g/100 g	Phosphorus	30 mg/100 g
Protein	1.30 g/100 g	Iron	1.00 mg/100 g

Fats	0.20 g/100g	Riboflavin	0.05 mg/100 g
Fibre	2.2 g/100 g	Niacin	0.60 mg/100 g
Minerals	0.60 g/100 g	Carotene	162 µg/100 g
Calorific value	260 Kcal/100 g	Vitamin C	5 mg/100 g

(Gopalan, 1985)

Phytochemicals

With the HPLC-PDA system, Veberic et al., (2008) have identified the following phenolics: gallic acid, chlorogenic acid, syringic acid, (+)-catechin, (−)-epicatechin and rutin. The chloroform extract from fig was found to be the richest in total flavonoid content (252.5 +/- 1.1 mg/g quercetin equivalent), while the n-butanol extract had the highest total phenol amount (85.9 +/- 3.2 mg/g extract gallic acid equivalent) as reported by Orhan et al., (2011).

Methanol extracts of *Ficus carica and Morus alba* showed potent antioxidant and hepatoprotective activities; in-depth chromatographic investigation of the most active extract (*Ficus carica* leaf extract) resulted in identification of umbelliferone, caffeic acid, quercetin-3-O-β-d-glucopyranoside, quercetin-3-O-α-l-rhamnopyranoside, and kaempferol-3-O-α-l-rhamnopyranoside (Singab et al., 2010).

Ficus carica also tested positive for alkaloids, flavonoids, coumarins, saponins, sterols and terpenes and these compounds were found to have some degree of antispasmodic activity in rabbits (Gilani et al., 2008). To study the potential health-promoting constituents of fig fruits, six commercial fig varieties differing in color (black, red, yellow, and green) were analyzed for total polyphenols, total flavonoids, antioxidant capacity, and amount and profile of anthocyanins by Solomon et al (2006). Using reversed-phase liquid chromatography (RP-LC), various concentrations of anthocyanins but a similar profile was found in all varieties studied. Hydrolysis revealed cyanidin as the major aglycon. Proton and carbon NMR confirmed cyanidin-3-O-rhamnoglucoside (cyanidin-3-O-rutinoside; C3R) as the main anthocyanin in all fruits. Color appearance of fig extract correlated well with total polyphenols, flavonoids, anthocyanins, and antioxidant capacity. Extracts of darker varieties showed higher contents of phytochemicals compared to lighter colored varieties. Fruit skins contributed most of the above phytochemicals and antioxidant activity compared to the fruit pulp. C3R contributed 92% of the total antioxidant capacity of the anthocyanin fraction.

Psoralen and bergapten are two of major active components of *Ficus carica* L leaves. Psoralen has anti-tumor, anti-bacterial and anti-viral activities while bergapten is used to cure vitiligo, psoriasis, and alopecia areata (Chinese Meical Dictionary, 1986; Chunyan, et al.,2009).

Pharmacological Evidence for medicinal properties of Fig

The study conducted by Gilani et al (2008) showed the presence of spasmolytic activity in the ripe dried fruit of *Ficus carica* possibly mediated through the activation of K(+)(ATP) channels along with antiplatelet activity which provides sound pharmacological basis for its medicinal use in the gut motility and inflammatory disorders. Shade dried leaves of *Ficus carica* were extracted using petroleum ether (60-80 degrees) and tested for antihepatotoxic activity on rats treated with 50 mg/kg of rifampicin orally. There was significant reversal of biochemical, histological and functional changes induced by rifampicin treatment in rats by petroleum ether extract treatment, indicating promising hepatoprotective activity (Gond and Khadabadi, 2008).

The antioxidative activities of water extract (WE) and crude hot-water soluble polysaccharide (PS) from *Ficus carica L*. fruit were investigated using various assays in vitro, including scavenging abilities on DPPH, superoxide and hydroxyl radicals and reducing power. The immunity activities of PS were evaluated using the carbon clearance test and serum hemolysin analysis in mice. In addition, total phenolics and flavonoids contents were also determined. Both WE and PS have notable scavenging activities on DPPH with the EC(50) values of 0.72 and 0.61 mg/ml, respectively. The PS showed higher scavenging activity than WE on superoxide radical (EC(50), 0.95 mg/ml) and hydroxyl anion radical (scavenging rate 43.4% at concentration of 4 mg/ml). The PS (500 mg/kg) also has a significant increase in the clearance rate of carbon particles and serum hemolysin level of normal mice. The results indicate that both WE and PS might be applicable in healthy medicine and food industry (Yang et al., 2009).

Aref et al., (2010) identified the antimicrobial activity of *Ficus carica* latex. The methanolic extract of *Ficus carica* L.latex had no effect against bacteria except for *Proteus mirabilis* while the ethyl acetate extract had inhibition effect on the multiplication of five bacteria species (*Enterococcus fecalis, Citobacter freundei, Pseudomonas aeruginosa, Echerchia coli and Proteus mirabilis*). For the opportunist pathogenic yeasts, ethyl acetate and chlorophormic fractions showed a very strong inhibition (100%); methanolic fraction had a total inhibition against *Candida albicans* (100%) at a concentration of 500 microg/ml and a negative effect against Cryptococcus neoformans. *Microsporum canis* was strongly inhibited with methanolic extract (75%) and totally with ethyl acetate extract at a concentration of 750 microg/ml.

The antioxidant, hepatoprotective and kidney protective activities of methanol extracts of *Ficus carica Linn*. (Moraceae) leaves and fruits and *Morus alba* Linn. root barks (Moraceae) are evaluated by Singab et al., (2010). Their results showed that methanol extracts of *Ficus carica* and *Morus alba* had potent antioxidant and hepatoprotective activities.

Health Benefits and Curative Properties

Ficus carica L, one of the oldest plant species in China, is abound in Shandong, Xinjiang, Jiangsu province and so on. Its fruits are delicious and can be eaten by human. Its leaves are commonly used to cure hemorrhoid and clear away heart ache (Chinese Medical Dictionary,1986).

- **Lower cholesterol:** Figs contain Pectin, a soluble fiber. When fiber goes through the digestive system, it mops up globes of cholesterol and carries them out of body.
- **Prevent coronary heart disease:** Dried figs contain phenol, Omega-3 and Omega-6 fatty acids. These fatty acids reduce the risk of coronary heart disease.
- **Prevent colon** cancer**:** The presence of fiber helps to mop up and usher out cancer causing substances.
- **Protection against post-menopausal breast cancer:** Fiber content in figs give protection against breast cancer.
- **Good for diabetic patients:** The American Diabetes Association recommends figs for a high fiber treat. Fig leaves reduce the amount of insulin needed by diabetic patients who have to take insulin injection. Fig is rich in Potassium. Potassium helps to control blood sugar. Fig leaves have anti-diabetic properties
- **Prevention of hypertension:** People used to take more sodium in the form of salt. Low potassium and high sodium level may lead to hypertension. Figs are high in potassium but low in sodium. So, it helps to avoid hypertension.
- **Strengthens bones:** Figs are rich in Calcium. Calcium helps to strengthen bones.
- **Urinary calcium loss:** People having high salt diet may be affected by increased urinary calcium loss. Potassium content in figs helps to avoid that.
- **Prevent macular degeneration:** Vision loss in older people is due to macular degeneration. Fruits and figs generally are good for avoiding this condition.
- **Relief for throat:** The high mucilage content in figs, helps to heal and protect sore throats.
- Figs are quite useful in various respiratory disorders including whooping cough and asthma.
- Since they are also good for digestion, they help in treating constipation, indigestion, stomach ache, etc.

- Figs are also good for fever, earache, boils, abscesses, venereal diseases and is excellent for the liver.
- Fig is a highly alkaline food, therefore helps to regulate the pH of the body.
- Figs are rich in flavonoids and polyphenols. These are antioxidants, which prevent the damage caused by free radicals.
- Fig is known for its soothing and laxative properties. Figs are low in fat and sugar.

(Source : http://www.organicfacts.net/health-benefits/fruit/health-benefits-of-figs-or-anjeer.html)

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38. Mysore Raspberry (*Rubus neveus* L.)

The species is native to Burma and India, particularly the lower Himalayas, from Punjab to Assam, the Deccan peninsula, and the Western Ghats; and is common in the evergreen forests of Mahabaleshwar. From India, the Mysore raspberry was introduced into Kenya, East Africa, and has been grown in the mountains there for many years.

Food Uses

The fruits are enjoyed fresh, alone or served with sugar and cream or ice cream. They are excellent for making pie, tarts, jam and jelly. The fresh fruits can be quick-frozen for future use.

Nutritional Composition of Raspberry fruits

Constituents	**Quantity**	**Constituents**	**Quantity**
Carbohydrates	14.7 g/100 g	Sodium	1 g/100 g

Proteins	1.5 g/100 g	Beta- carotene	120 µg/100 g
Fats	0.80 g/100 g	Vitamin C	54 mg/100 g
Calcium	3 mg/100 g	Dietary Fibre	8 g/100 g
Iron	5 mg/100 g	Energy	63 Kcal/100 g

(Morton, 1987)

Phytochemicals

Raspberries contain significant amounts of polyphenol antioxidants such as anthocyanin pigments linked to potential health protection against several human diseases. The aggregate fruit structure contributes to its nutritional value, as it increases the proportion of dietary fiber, placing it among plant foods with the highest fiber contents known, up to 20% fiber per total weight. Raspberries are a rich source of vitamin C, and dietary fiber. Contents of B vitamins 1-3, folic acid, magnesium, copper and iron are considerable in raspberries.

Raspberries rank near the top of all fruits for antioxidant strength, particularly due to their dense contents of ellagic acid, quercetin, gallic acid, anthocyanins, cyanidins, pelargonidins, catechins, kaempferol and salicylic acid. Yellow raspberries and others with pale-colored fruits are lower in anthocyanins.

Due to their rich contents of antioxidant vitamin C and the polyphenols mentioned above, raspberries have an ORAC value (oxygen radical absorbance capacity) of about 4900 per 100 grams, including them among the top-ranked ORAC fruits. Although there are no clinical studies to date proving these effects in humans, antioxidant and antiproliferative (chemopreventive) effects against cancer have been linked to the amount of phenolics and flavonoids in various foods including raspberries.

The color of the raspberry juice correlated well to the total phenolic, flavonoid, and anthocyanin contents of the raspberry. The antioxidant activity of the raspberry was directly related to the total amount of phenolics and flavonoids found in the raspberry (Liu et al, 2002). Quercetin glucuronide, quercetin-3-O-glucoside and rutin were identified in the leaf extracts of raspberry (Venskutonis et al, 2007). The separation of anthocyanins present in the fruits of 11 varieties of red raspberries (*Rubus idaeus* L.) was performed using high performance liquid chromatography (HPLC) by Sparzak et al (2010). The varieties Heritage and Willamette had the simplest anthocyanin sets consisting of only two predominant anthocyanins--cyanidin-3-O-sophoroside (1) and cyanidin-3-O-glucoside (3), while in the other varieties two other predominant compounds were also present, cyanidin-3-O-rutinoside (4) and cyanidin-3-O-(2(G)-O-glucosylrutinoside) (2).

Pharmacological Evidence for medicinal properties of Raspberry

Liu et al (2002) found that the proliferation of HepG(2) human liver cancer cells was significantly inhibited in a dose-dependent manner after exposure to the raspberry extracts.

Patel et al (2004) reported that there are certain biologically active compounds in *R. idaeus*, the leaves of which have been used traditionally as a uterine relaxant and stimulant during confinement, for the treatment of diarrhoea and similar enteric disorders and as an astringent. Investigations of other *Rubus species* have been conducted in the last twenty-five years, and have shown possible application for a wide range of indications, including bacterial infections, anxiety, pain and inflammation (Patel et al, 2004).

The antimicrobial properties of raspberry juice cordial, raspberry juice, raspberry leaf extract and a commercial brand of raspberry leaf tea were investigated against five human pathogenic bacteria and two fungi. Raspberry cordial and juice were found to significantly reduce the growth of several species of bacteria, including *Salmonella, Shigella and E. coli*, but demonstrated no antifungal activity. No antimicrobial activity was detected in the leaf extract or tea (Ryan et al, 2001).

The health benefits of raspberry or raspberry constituents have been ascribed to: antioxidant [Wang and Lin, 2000; Parry et al, 2005), anti-inflammation (Popkov et al, 2001), low body weight (Morimoto et al, 2005), and inhibitory cancer cell growth (Seeram et al, 2006; Boivin et al, 2007; Aiyer et al, 2008). Raspberry extract and its constituents had potent antioxidant capacity, and inhibited the growth of mammary, oral, colon, prostate and liver cancer cells in a dose-dependent manner
(Seeram et al , 2006; Liu et al, 2002).

Health Benefits and Curative Properties of Raspberry

(http://hubpages.com/hub/Health-Benefits-of-Raspberry)

- Raspberry tea is one of the best herbal teas for pregnancy: to relieve nausea, prevent hemorrhage, reduce pain, and ease childbirth.
- The leaves of raspberry is used fresh or dried as herbal teas to regulate menstrual cycles and to decrease heavy menstrual flow.
- The fresh juice, mixed with little honey, makes an excellent refrigerant beverage, to be taken to reduce fever.
- Raspberry can help increase breast milk after the baby is born.

- Externally, because of its astringent qualities, raspberry tea is used as a gargle, mouthwash. It can also be used for bleeding gums and other oral inflammations.

- Raspberries contain an antioxidant **ellagic acid** which protects your cells from becoming damaged and slows the growth of abnormal cells. Ellagic acid retains its potency after heating, freezing and concentration processing.

- Eating red raspberries may possibly prevent cancer by inhibiting the abnormal division of cells. Research has found that black raspberries appear to be as helpful as red raspberries in preventing or slowing the growth of cancer. In a study it was shown that one cup of raspberries per week will stop prostate cancer growth for a period of up to one week.

- Raspberries may help normalize glucose levels and therefore may be helpful to people with diabetes.

- Raspberry relieves urinary irritation, and soothes the kidneys and the entire urinary tract.

- Raspberries contain powerful antioxidants that can prevent overgrowth of certain bacteria and fungi in the body.

- Raspberry can help prevent age-related cognitive decline.

- Raspberry can prevent degeneration of eyesight.

- Raspberry promotes healthy nails, bones, teeth, and skin.

- The tea is also used for measles.

- Raspberry tea is a gentle anti-diarrhea.

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39. Passionfruit (*Passiflora edulis* Sims).

Passion fruit (Passiflora edulis Sims) belongs to the family Passiflora. Within this species, there are two distinct forms, the standard purple, and the yellow, distinguished as *P. edulis* f. *flavicarpa* Deg., and differing not only in color but in certain other features. The purple passionfruit is native from southern Brazil through Paraguay to northern Argentina. India, for many years, has enjoyed a moderate harvest of purple passionfruit in the Nilgiris in the south and in various parts of northern India. In many areas, the vine has run wild. The yellow form was unknown in India until just a few decades ago when it was introduced from Ceylon and proved well adapted to low elevations around Tamil Nadu and Kerala.

Uses

Passionfruit juice can be boiled down to a sirup which is used in making sauce, gelatin desserts, candy, ice cream, sherbet, cake icing, cake filling, meringue or chiffon pie, cold fruit soup, or in cocktails. The seeded pulp is made into jelly or is combined with pineapple or tomato in making jam.

Nutritional Composition of Passionfruit

Constituents	Quantity	Constituents	Quantity
Moisture	75.1 g/100 g	Iron	1.60 mg/100 g
Carbohydrates	21.20 g/100 g	Sodium	28 mg/100 g
Protein	2.20 g/100 g	Potassium	348 mg/100 g
Fat	0.70 g/100 g	Vitamin A	700 IU/100 g
Ash	0.80 g/ 100g	Riboflavin	0.13 mg/100 g
Calcium	13 mg/100 g	Niacin	1.50 mg/100 g
Phosphorus	64 mg/100 g	Ascorbic Acid	30 mg/100 g

(Morton, 1987)

Phytochemicals

The yellow passionfruit has somewhat less ascorbic acid than the purple but is richer in total acid (mainly citric) and in carotene content. It is an excellent source of niacin and a good source of riboflavin. Free amino acids in purple passionfruit juice are: arginine, aspartic acid, glycine, leucine, lysine, proline, threonine, tyrosine and valine. Carotenoids in the purple form constitute 1.160%; in the yellow, 0.058%; flavonoids in

the purple, 1.060%; in the yellow, 1.000%; alkaloids in the purple, 0.012%; in the yellow, 0.700% (mainly harman), and the juice is slightly sedative. Starch content of purple passionfruit juice is 0.74%; of the yellow, 0.06%. The estimation of different kinds of phytochemicals in passionfruit exhibited the presence f saponin, tannin and phenolic compounds, flavanoids, steroids and terpenoids (Sunitha and Devaki, 2009).

Pharmacological Evidence for the medicinal properties of Passionfruit.

There is currently a revival of interest in the pharmaceutical industry, especially in Europe, in the use of the glycoside, *passiflorine,* especially from *P. incarnata* L., as a sedative or tranquilizer. Italian chemists have extracted *passiflorine* from the air-dried leaves of *P. edulis.*

In Madeira, the juice of passionfruits is given as a digestive stimulant and treatment for gastric cancer. In traditional system of medicine, ***P. edulis*** is used as sedative, antiasthmatic and emetic (TheWealth of India, 2003).***P. edulis*** leaves are used in the treatment of insomnia and traditionally known to produce a restful sleep without any narcotic hangover. The leaves are reported to contain a bitter principle maracugine, resins, acids and tannin exceptionally rich in ascorbic acid. It is also used to treat epilepsy, ulcers and haemorrhoids (Relw and Espig, 1991).

The popular medicine *Passiflora edulis* has been used as a sedative, tranquilizer, against cutaneous inflammatory diseases and intermittent fever. *Passiflora edulis* administered by intraperitoneal route (i.p.) inhibited the leukocyte, neutrophils, myeloperoxidase, nitric oxide, TNFalpha and IL-1beta levels in the pleurisy induced by carrageenan. *Passiflora edulis* also inhibited total and differential leukocytes in the pleurisy induced by bradykinin, histamine or substance P. Several mechanisms, including the inhibition of pro-inflammatory cytokines (TNFalpha, IL-1beta), enzyme (myeloperoxidase) and mediators (bradykinin, histamine, substance P, nitric oxide) release and/or action, appear to account for *Passiflora edulis's* actions (Montanher et al, 2007).

The studies conducted by Silva et al (2011) indicated that pectin, a bioactive compound present in *P. edulis*, has potential as a useful alternative treatment for type 2 diabetes. Its anti-inflammatory properties are probably involved in its antidiabetic action.

Piceatannol is present in passion fruit (*Passiflora edulis*) seeds in high amounts. In a study, Sano et al (2011) isolated the second major polyphenolic compound of passion fruit seeds and identified it as scirpusin B, which is a dimer of piceatannol. They also investigated the antioxidant activities and vasorelaxing effects of these polyphenols. They reported that both polyphenolic compounds exhibited potent antioxidant activities and significant vasorelaxant effects in endothelium-intact aorta. More specifically, scirpusin B exerted a greater antioxidant activity and vasorelaxant effect compared with piceatannol. Additionally, the vasorelaxation effects of the compounds were induced via the NO derived from the endothelium.

Health Benefits and Curative Properties of Passion fruit

- Passion fruit juice is an excellent digestive stimulant and helps in the treatment of other gastric ailments.
- Passion fruit seeds contain high amount of fiber that the body needs to cleanse the colon, improve digestion, and help prevent heart attacks and strokes.
- Passion fruit is high in vitamin A which helps the body to remove free radicals that cause skin and tissue damage, and it also helps to improve our vision.
- It is also rich in Vitamin C which helps to repair tissue, helps prevent heart disease and cancer and helps our bones.
- There is also a compound in passion fruit that is believed to block histamine, reduce allergy and inflammation; passion fruit therefore has the health benefit of reducing the symptoms of asthma.
- The antioxidants found in passion fruit have been found to inhibit the growth of cancer cells.

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http://hubpages.com/hub/Health-Benefits-of-Passion-Fruit

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40. Persimmon (*Diospyros kaki* L.)

In great contrast to the native American persimmon, *Diospyros virginiana* L., which has never advanced beyond the status of a minor fruit, an oriental member of the family Ebenaceae, *D. kaki* L. f ., is prominent in horticulture. Perhaps best-known in America as the Japanese, or Oriental, persimmon, it is also called kaki (in Spanish, *caqui),* Chinese plum or, when dried, Chinese fig. The tree is native to Japan, China, Burma and the Himalayas and Khasi Hills of northern India.

Uses

Fully ripe Japanese persimmons are usually eaten out-of-hand or cut in half and served with a spoon, preferably after chilling. Some people prefer to add lemon juice or cream and a little sugar. The flesh may be added to salads, blended with ice cream mix or yogurt, used in pancakess, cakes, gingerbread, cookies, gelatin desserts, puddings, mousse, or made into jam or marmalade. The pureed pulp can be blended with cream cheese, orange juice, honey and a pinch of salt to make an unusual dressing.

Nutritional Composition

Constituents	**Quantity**	**Constituent**	**Quantity**
Moisture	78.6 g/100 g	Magnesium	8 mg/100 g
Carbohydrates	19.6 g/100 g	Carotene	2710 IU/100 g
Protein	0.40 g/100 g	Thiamine	0.03 mg/100 g
Fat	0.40 g/100 g	Riboflavin	0.02 mg/100 g
Calcium	6 mg/100 g	Niacin	0.10 mg/100 g
Phosphorus	26 mg/100 g	Ascorbic Acid	11 mg/100 g
Iron	0.30 mg/100 g	Energy	77 Kcal/100 g
Potassium	174 mg/100 g		

(Morton, 1987)

Phytochemicals

Persimmon (*Diospyros kaki*) is fruit that has been cultivated for a long time in Japan and also used in folk medicine. Persimmon contains several biologically active

compounds such as carotenoids, tannins, terpenoids and flavonoids (Mallavadhani et al, 1998).

The activity-guided purification of the Persimmon peel extract resulted in isolation of two active compounds, which have been identified as flavonoid glycosides, isoquercitrin (quercetin-3-O-glucoside) and hyperin (quercetin-3-O-galactoside) by spectral analysis (Ohguchi et al, 2010).

Zhou et al (2011) reported that 31 specific carotenoids were detected in persimmons, among which nine specific carotenoids were characterized. β-cryptoxanthin was the most abundant carotenoid among all individual components in both the peel and the flesh. Zeaxanthin was also the most abundant in all persimmon fleshes besides β-cryptoxanthin, and the total amount of these two components accounted for 37.84-85.11% of the total carotenoids.

The 2-methoxy-4-vinylphenol (8) which is component of persimmon peel had high antioxidant activity on the DPPH radical scavenging assay and SOD (superoxide dismutase) assay. It also had higher tyrosinase inhibiting activity than that of arbutin using both L-tyrosine and L-DOPA as substrates (Fukai et al, 2009).This has several uses in cosmetic industry as whitening agent. Persimmon is one of the few fruits rich in proanthocyanadins (PA) (Ikegami et al, 2009).

Phamacological Evidence for medicinal properties of Persimmon

Acetone extract of the peel of Japanese persimmon (Diospyros kaki 'Fuyu') inhibits melanin biosynthesis in mouse B16 melanoma cells. The inhibitory effects were found to be mediated by suppression of tyrosinase expression (Ohguchi et al, 2010).

Matsumoto et al (2008) studied the hypolipidemic effects of young persimmon fruit (YP) on apolipoprotein E-deficient C57BL/6.KOR-ApoEshl mice. YP treatment significantly lowered plasma chylomicron, very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL) cholesterols, and triglyceride, and this response was accompanied by an elevation of fecal bile acid excretion. In the liver, sterol regulatory element binding protein-2 gene expression was significantly higher in mice fed YP, while the mRNA and protein levels of the LDL receptor did not change. These results indicated that acceleration of fecal bile acid excretion is a major mechanism of the hypolipidemic effect induced by YP in C57BL/6.KOR-ApoEshl mice.

Recent evidence strongly suggests that oxidative stress due to redox imbalance is causally associated with inflammatory processes and various diseases including diabetes. Lee et al (2007) examined the effects of proanthocyanidin from persimmon peel, using both oligomers and polymers, against oxidative stress with elucidation of the underlying mechanisms in streptozotocin-induced diabetic rats. The elevation of lipid peroxidation in the kidney and serum under the diabetic condition was decreased by the administration of proanthocyanidin. The suppression of reactive oxygen species generation and elevation of the reduced glutathione/oxidized glutathione ratio were observed in the groups

administered proanthocyanidin. These results support the protective role of proanthocyanidin from oxidative stress induced by diabetes. Moreover, proanthocyanidin, especially its oligomeric form, affected the inflammatory process with regulation of related protein expression, inducible nitric oxide synthase, cyclooxygenase-2, and upstream regulators, nuclear factor kappaB, and inhibitor-binding protein kappaB-alpha. Proanthocyanidin ameliorated the diabetic condition by decreases of serum glucose, glycosylated protein, serum urea nitrogen, urinary protein, and renal advanced glycation endproducts. In particular, oligomeric proanthocyanidin exerted a stronger protective activity than the polymeric form.

Nutrition & Health Benefits of Eating Persimmon:

- Persimmon fruit is low in calories and fats, which add up as its biggest benefit. It is also a rich source of dietary fiber.

- Persimmons are replete with many phyto-nutrients flavonoid poly-phenolic anti-oxidants. Catechins and gallocatechins as well as important anti-tumor compound betulinic acid contained in this fruit is said to be highly beneficial for health. Catechins are known to have anti-infective, anti-inflammatory and anti-hemorrhagic properties.

- The fruit is also rich in anti-oxidant compounds like vitamin-A, beta carotene, lycopene, lutein, zeaxanthin and cryptoxanthin. These compounds offer protection against oxygen-derived free radicals and reactive oxygen species (ROS) responsible for ageing and a host of other health problems.

- Persimmons are a rich source of vitamin-C. Their regular consumption helps the body build immunity against contagious forces and protects against harmful, pro-inflammatory free radicals.

- Fresh persimmon fruits contain healthy amounts of minerals like potassium, manganese, copper and phosphorus. These minerals are believed to be powerful free radical scavengers and boost the production of blood cells.

- Persimmon tannins calm intestinal movements and relieve diarrhea too. They are also effective in treating bruises, as tannins are believed to slow down subcutaneous bleeding. Persimmon tannin protects cells, astringes tissues and suppresses the propagation of bacteria. It is also known to work against influenza and viral flu.

- Persimmon is good for skin. It makes for an excellent facial mask. Just take the flesh of persimmons, add yolk and lemon juice and make a face pack out. It is known to be effective against pores and wrinkles.

  (http://www.unp.me/f150/benefits-of-persimmon-74357/)

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