Tea for Health

TISSA AMARAKOON

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The Tea Research Institute of Sri Lanka

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Cover courtesy Ceylon Tea Board

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Foreword

Degenerative diseases, also referred to as diseases of civilisation, are becoming widespread with industrialisation. These diseases are the top ten causes of death after reaching 45 years of age. Heart disease, stroke, cancer and diabetes are the commonest degenerative diseases. Diet plays the most important role in preventing degenerative diseases. Therefore, the attention of bio-medical scientists and nutritionists in recent times is focused on identifying beneficial components in diets.

The concerted efforts of the Tea Research Institute of Sri Lanka, Sri Lankan tea growers and the traders paved the way to offer a fresh, natural and healthy beverage of high quality to the world, which meets the criteria to qualify as part of the modern day healthy diet. These efforts earned for 'Ceylon Tea' the prestigious accolade in 1997: "Sri Lankan Tea is the cleanest in the world in relation to pesticide residues." Ceylon Tea has secured this fame unbroken to date.

Recent research carried out at The Tea Research Institute of Sri Lanka and other reputable laboratories around the world have shown that regular drinking of both black and green tea could reduce the risk of degenerative diseases. Therefore, tea could easily fit into a modern day balanced diet. This publication intends to give the reader an authentic review of the recent research findings in simple language.

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History of Tea – Medicine or Beverage?

In 2737 BC, a few leaves of tea blown by chance into Chinese Emperor Shen Nung's drinking water made a remarkable impact on man's drinking habits. He found that the resulting brew was more pleasant to drink than hot water. With this legendary discovery of tea, Emperor Shen was convinced that tea improved health and recommended it as a "remedy for kidney trouble, fever, chest infection and tumours that come about the head." The Emperor claimed that tea was able to detoxify 72 different kinds of poison. In those early days of tea, only the Emperor and the royal court circles were privileged to enjoy tea, which was considered a medicinal drink.

The habit of tea drinking slowly spread to the masses in China and by the end of the 6th century, the Chinese began to regard tea as not only a medicinal drink but also as a refreshment. Strong beliefs about tea's medicinal properties accompanied its spread from China to other parts of the world. This was evident in 1675 when Thomas Garway offered tea for the first time to the public in his London coffee house. He went on to expound the virtues of tea to his customers in the first broadsheet advertisement of tea:

" It maketh the Body active and lusty
It helpeth the Head-ach,
giddiness and heaviness thereof.
It removeth the Obstructions of the Spleen.
It is very good against the Stone and Gravel,
cleansing the Kidneys and Vriters being
drank with Virgins Honey instead of Sugar.
It taketh away the difficulty of breathing,
opening Obstructions.
It is good against Lipitude Distillations,
and cleareth the Sight.
It removeth Lassitude, and cleanseth and purisieth
adult Humors and a hot Liver.
It is good against Crudities,
strengthening the weakness of the
Ventricle or Stomack,
causing good Appetite and Digestion,
and particularly for Men of a corpulent
Body, and such as are great eaters of Flesh.
It vanquisheth heavy Dreams, easeth the Brain,
and strengtheth the Memory....."

Today the tea drinking habit has spread all over the world. It is second only to water as the most favourite beverage on earth. Most people drink tea as a social drink because of its pleasant and stimulating character. Although Emperor Shen's and Thomas Garway's pronouncements may sound extravagant to some, recent biomedical research confirms the centuries-old lore about the power of tea in preventing illness and prolonging life.

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Types of Tea: Black, Green and Oolong Tea

Tea is processed from the tender shoots (typically the bud and the first two leaves) of the tea plant; the botanical term for the plant is *Camellia sinensis.*

WHAT IS NOT TEA ?

Traditionally the word tea is used to describe the tea plant (*Camellia sinensis*) and products made using parts of the tea plant. However, on some occasions the word tea is used to describe products made using parts of other plants. This has led to confusions and ambiguity as some people think that these products are made from *Camellia sinensis* and therefore have similar health benefits as true tea.

The chemical composition of the beverages made from other plant species is quite different to that of *Camellia sinensis.* Therefore, the effects of these beverages on human health will also be different. Chemical composition of these beverages and their effects on human health have not been studied in great detail as in *Camellia sinensis.*

Identifying these products on the market shelf and differentiating from true tea is also difficult as terminology used is ambiguous. Usually these products are referred to as 'herbal teas'. On most occasions the word tea is preceded by the name of the plant. (Eg. Chamomile tea, Peppermint tea and Rooibos tea.) Ambiguity arises when common names are used to describe these products. (Eg. 'Red tea' is sometimes used to describe rooibos

tea.) Therefore, one should carefully select tea made from *Camellia sinensis* to receive the health benefits attributed to tea.

TYPES OF TEA MADE FROM TEA (*Camellia sinensis*) LEAVES

In different regions of the world, various types of tea (many types showing only subtle differences) are produced from the tender shoots of the *Camellia sinensis.* These teas could be grouped into three main types: Black, Green and Oolong teas. Their differences derive from the method of processing those tender shoots.

Black tea accounts for 78% of the world's tea production and the major producing countries are Sri Lanka (Ceylon), India and Kenya. Green tea accounts for 20% of teas produced in the world and the major producers are China and Japan. Oolong tea accounts for only 2% of the production, with its consumption and production mainly confined to Taiwan and some parts of China.

THE CHEMICAL COMPOSITION OF TENDER TEA SHOOTS

g/100g dry weight

Cold Water-Soluble		
Flavanols:	Epigallocatechin gallate (EGCG)	9 - 13
	Epigallocatechin (EGC)	3 - 6
	Epicatechin gallate (ECG)	3 - 6
	Epicatechin (EC)	1 - 3
	Gallocatechin (GC)	1 - 2
	Catechin (C)	1 - 2
Flavonols and their glycosides		3 - 4
Leucoanthocyanins		2 - 4
Phenolic acids		4
Total Polyphenols		**27- 40**

Caffeine	3 - 4
Amino acids: Theanine	2
Others	2
Carbohydrates	4
Organic acids	0.5
Volatile compounds	0.01
Partially Hot Water-Soluble	
Polysaccharides: Starch	2 - 5
Other	12
Protein	15
Ash (inorganic material)	5
Water-Insoluble	
Cellulose	7
Lignin	6
Lipids	3

The major water soluble chemical components in the tender shoots of tea are a class of chemical compounds known as polyphenols. Polyphenols contribute mostly to the taste of tea. The polyphenols in tea fall into the sub group 'flavonoids', which have common structural and functional features. 'Flavanols' are the predominant type of flavonoids in tea. Flavanols in tea are commonly referred to as catechins.

In "Black Tea" processing, the plucked shoots (the bud and the first two leaves) are withered to reduce the moisture content approximately by 50%. Then the shoots are rolled by mechanical rollers to macerate and break them into parts. This process of breaking up the leaves starts a series of chemical reactions that are catalysed by the enzymes in the leaf.

These chemical reactions are allowed to take place in the next stage of processing called 'fermentation'. (Although the word 'fermentation' is used for this stage, external micro-organisms are not involved in the process and alcohol is not produced.) The major reaction is the conversion of catechins (flavanols), the major component in the leaf, to what is known as theaflavins

and thearubigins, dimeric and polymeric polyphenolic compounds, which are mainly responsible for the taste and character of black tea.

The next stage is the drying of tea at high temperature to reduce the moisture content to 3%, to improve the keeping qualities. High temperatures in dryers inactivate the enzymes. Then the teas are graded according to particle size by sifting. Well-known black tea grades include Orange Pekoe (OP), Broken Orange Pekoe (BOP), Broken Orange Pekoe Fannings (BOPF) and Dust.

The major difference in "Green Tea" processing is that after plucking, the shoot is subjected to heat by steaming or dropping onto a heated pan. This inactivates the enzymes and therefore, after rolling, the 'fermentation' reactions do not take place. Thus the chemical composition of green tea is similar to that of the fresh tender shoots.

In "Oolong Tea" production, the process is similar to that for black tea. However, after rolling, the rolled leaf is allowed to 'ferment' for a short period only. Oolong teas are known as partially fermented teas and the chemical composition is somewhere between that of black tea and green tea, depending on the degree of fermentation.

FRESHNESS OF TEA AND STORAGE

Tea is very hygroscopic (readily absorbs moisture) in nature. Therefore, if exposed to atmospheric air it will absorb moisture resulting in rapid deterioration in quality and taste. In addition, tea could absorb volatile compounds in atmospheric air resulting in masking the real flavour and aroma of tea.

Scientific studies have shown that during the storage of tea, the catechins and theaflavins are converted to thearubigins due to residual enzyme activity. This will result in a 'flat' taste

and reduction of brightness in the liquor. *In vitro* studies have shown that the catechin and theaflavin fractions posses higher anti-oxidant activities than the thearubigin fraction. Therefore, storing tea for long durations under conditions which allow moisture absorption could reduce the anti-oxidant activity of tea.

Breakdown of lipids during storage of tea results in the liberation of free fatty acids. Oxidation of free fatty acids on brewing leads to rancidity and 'off taste' in tea.

Rates of reaction in the above have a direct correlation with the moisture content and storage temperature of tea. Higher moisture contents and higher temperatures will lead to rapid reactions and rapid deterioration of tea. In addition, high moisture levels will also increase the microbial activity leading to undesirable 'taints'.

Exposure to light will also lead to what is called 'non enzymatic browning reactions'. This results in a duller appearance of tea. Therefore, using packing material that excludes light is also important.

When tea comes out of the drier (the last stage in processing) the moisture content is reduced to 3-4%. At this moisture level, the above reactions will take place at minimum rates. Therefore, air tight packaging with material that does not allow light to penetrate and rapid despatch to the consumer will ensure that freshness of tea is preserved. Ideal conditions for storing tea are at low temperatures in a refrigerator under such packaging.

Once a pack is opened, storing at low temperature in an odourless airtight container which does not allow light to penetrate, will ensure that freshness of tea is preserved.

BT Images

STEPS IN THE PROCESSING OF BLACK AND GREEN TEA

Plucking
(Tender shoots)

Withering
(moisture reduced)

Rolling
(leaf macerated and broken)

'Fermentation'
(Enzymic conversion of catechins to theaflavins & thearubigins)

Drying

Black tea
(most of the catechins converted to theaflavins and thearubigins by enzymic reaction)

Steaming or Pan firing
(enzymes destroyed by heat)

Roll drying
(leaf macerated, broken and dried)

Green tea
(chemical composition similar to young shoots)

BT Images

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What's in a Cup

The important components of made tea, as far as tea and health are concerned, are the water soluble components that come into the cup on brewing. A typical brew of tea contains 0.35% tea solids in water. A group of chemical compounds known as polyphenols are the major component in the solids released into water.

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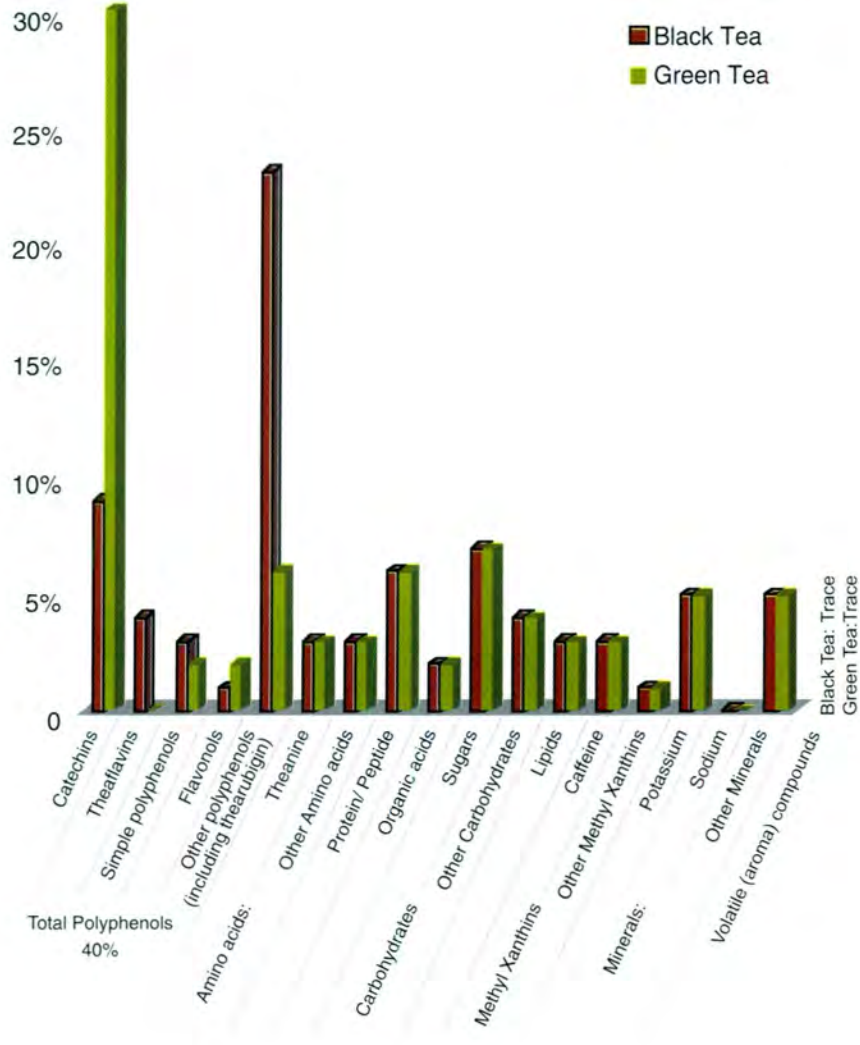
THE COMPOSITION OF A TYPICAL TEA BEVERAGE



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A Calorie Free, Low Sodium Beverage

Tea (without milk and sugar) does not contain significant amounts of nutrients. The calorific value of tea is almost zero, making it an ideal drink for the modern day calorie conscious consumer. Although rich in potassium, the sodium content in tea is very low. This makes tea an ideal beverage for hypertensive individuals.

Caffeine and polyphenols, the major non-nutrient components in tea, have pharmacological effects. Caffeine, the well-known stimulant, acts on the central nervous system, increases alertness and reduces feelings of drowsiness and fatigue. The polyphenols, which include catechins, theaflavins, thearubigins and other flavonoids are mainly responsible for the beneficial effects of tea. Polyphenols are found in most plants, hence also in food derived from plant sources.

Scientific investigations have found that polyphenols could act as antioxidants after consumption, thus decreasing the risk of many diseases. Tea contains uniquely high amounts (up to 40% of the solids extracted into the brew) of polyphenols. Dietary surveys done in Europe and USA have shown that tea is a major source of dietary polyphenols.

DIETARY SOURCES OF POLYPHENOLS

	(mg/serving)*
Black Tea	120 - 300
Green Tea	100 - 200
Red Wine	40 - 140
Apples	6 - 15
Soy Beans (Dry)	76 - 207
Tofu	35 - 63
Onions	28
Blueberries	2 - 36
Tart Cherries	26 - 33
Kale	22
Leaf Lettuce	17

**USDA Serving Sizes (Handbook 8)*

Tea also contains significant amounts of fluoride, which helps to reduce tooth decay. Dietary surveys in Britain have shown that the fluoride intake from tea was 0.6 – 2.7 mg per day per person. Similar studies in Australia, India and Sri Lanka have shown that the fluoride intake from tea is in the range of 0.5 – 2.00 mg. Studies have also shown that fluoride is in an easily available form in tea, thus helping to improve oral health.

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Importance of a Healthy Diet

DISEASES OF MODERN LIFE

During the last 400 years the average human life span has increased from 40 to 75 years. Advances in medical science have mainly contributed to this by controlling life-threatening infectious diseases. However, this has created another problem, known as "population ageing". Today, around 580 million elderly (60 years and more) people live in the world. By 2020 the number of elderly people worldwide will reach 1000 million.

In this scenario, chronic degenerative diseases such as heart disease and cancer are the biggest problems faced by medical scientists. Environmental pollution, changed food habits, additives in food, sedentary lifestyles and stress, have contributed to the increased incidence of these diseases. "Population ageing" has also aggravated the problem.

As a result the demand for health care services in cardiovascular, neurological, cancer and rheumatological diseases, and other physical and mental problems of the old will gradually increase. This will impose bigger burdens on the national health services and will consume a large slice of the national income. In addition to these direct costs, these diseases could prevent individuals from achieving their full potential in a productive life span.

Most people desire a long life. The best way to ensure that a person will reach old age in good health and be capable of contributing to society intellectually, spiritually and physically is to encourage him/her to adopt preventive measures against common degenerative diseases.

A PREVENTIVE LIFESTYLE

The more common degenerative diseases (heart disease, stroke and cancer) are caused by either genetic factors or an individual's lifestyle. While the individual has little control over the former, life styles can be changed to incorporate preventive measures against degenerative diseases. Some of these preventive measures are inexpensive and easily adopted, particularly those measures that relate to diet and exercise.

THE ROLE OF DIET IN A PREVENTIVE LIFESTYLE

Diet plays a major role in the prevention of diseases. A balanced diet without excess calories could greatly reduce the risk of the diseases of modern life. The beverages we consume, often ignored by nutritionists, are an important component of our diet.

Water is essential for life. The daily water requirement of a young man (70 kg) leading a sedentary life in a temperate country is about 2.5 litres per day. Around 50% of this is obtained from the moisture in solid food. The balance has to be taken in liquid form.

Although this entire requirement could be obtained as water, most people tend to drink other beverages. Inappropriate beverage consumption can lead to an excessive intake of calories and minerals, such as sodium which predispose individuals to hypertension. Tea, therefore, is a rational alternative to water as the sodium and calorie content in tea is quite negligible. Further, emerging scientific data suggests that tea drinking has an additional advantage: Tea can help reduce the risk of the diseases of modern life and improve the quality of life.

TEA IN A PREVENTIVE LIFESTYLE

Often heart disease and cancer are initiated by the damage at cellular level by harmful molecules. A large number of biochemical reactions (metabolic processes) that are essential for life take place in our body. During these processes reactive molecules called free radicals (FR) are formed. These are unavoidable by-products of the normal metabolic processes. Most of the free radicals generated in our body contain oxygen atoms and are therefore referred to as reactive oxygen species (ROS). As they are very reactive, FR and ROS could react with other molecules and damage cells, tissues and organs in the body.

Not only are free radicals generated in these normal processes, but they are also generated in the body when exposed to ultra violet (UV) light from the sun and other forms of radiation. In addition, humans are exposed to free radicals in cigarette smoke, car exhaust, industrial fumes and other environmental pollutants. Pathogenic micro-organisms and some environmental pollutants could activate our immune system. An activated immune system also generates large amounts of free radicals with the intention of destroying the invading pathogens. Although essential in destroying pathogenic micro-organisms, exposure to excessive amounts of free radicals under these conditions could also damage our body tissues and organs.

Exposure of the body systems to excessive free radicals is called 'oxidative stress'. Prolonged oxidative stress could damage the cells in human organs and lead to disease conditions like cardiovascular diseases (heart disease), cancer, cataract and rheumatoid arthritis. Free radicals are also involved in the ageing process. Anti-oxidants in diets could attenuate the 'oxidative stress'.

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Anti-oxidants

Damage by excessive free radicals can be limited or even prevented by anti-oxidants, which can neutralise free radicals. The human body itself produces and contains anti-oxidants to prevent the harmful effects of free radicals. In addition to these natural anti-oxidant mechanisms in the body, anti-oxidants derived from the diet also play an important role in checking free radicals. Increased intake of dietary anti-oxidants is much more important today to limit the damage caused by increased exposure to free radicals from environmental pollution.


Majestiya Plantations

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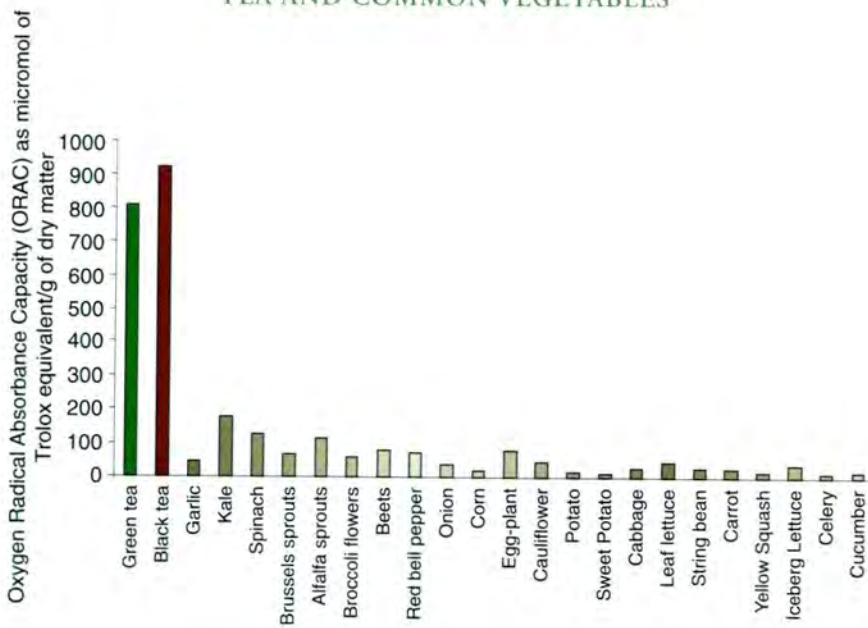
Green and Black Tea as Anti-oxidants

Until recently green tea was thought to be the most, or only, effective anti-oxidant-containing tea, and that green tea catechins alone were the anti-oxidants that gave tea its therapeutic attributes. It is now well-known that the theaflavins and thearubigins produced by the polymerisation of catechins during the 'fermentation' stage in the manufacture of black tea are equally effective anti-oxidants.

Many *in vitro* studies have demonstrated the anti-oxidant properties of both black and green tea, as well as the anti-oxidant activity of the polyphenols in tea. Further studies have shown that these anti-oxidant components of tea are absorbed into the blood circulation from the digestive tract and act as anti-oxidants in body systems. These findings indicate that tea drinking helps to reduce the risk of common degenerative diseases like heart disease, stroke and cancer.

Therefore, tea is not only a safe beverage in terms of calories and sodium but also has additional benefits as it contains uniquely high amounts of anti-oxidant polyphenols.

TOTAL ANTI-OXIDANT CAPACITY OF TEA AND COMMON VEGETABLES



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Tea and Heart Disease

International research has found that tea drinking could help to reduce the risk of heart disease. The most common form of heart disease is coronary heart disease (CHD). Coronary heart disease is caused by either partial or complete blockage of the arteries supplying blood to the heart wall and muscles (coronary arteries). A continuous and unrestricted blood supply by coronary arteries is essential for the heart to continue the smooth pumping of blood by the action of the heart muscle. Restriction of the blood flow in arteries occurs when the arteries are thickened by plaque formation in the inner lining of the artery wall. This is called arteriosclerosis. A blood clot could easily block the thickened artery completely (thrombosis).

Plaque formation in arteries is a gradual process and lipids (fat), including cholesterol, are the main constituents in plaque. Certain factors, such as high levels of lipids and oxidation of lipids, facilitate the deposition on the walls of the arteries. 'Oxidative stress' or high amounts of free radicals and reactive oxygen species facilitate the plaque formation. Scientific investigations have found that anti-oxidants could reduce the amount of oxidant species in the circulatory system and therefore reduce plaque formation.

TEA REDUCES OXIDATION OF FAT

Many scientific investigations have been aimed at finding the ways in which tea reduces 'oxidative stress' and plaque formation. These studies

have revealed that both green tea polyphenols (catechins) and black tea polyphenols (theaflavins and thearubigins) have the ability to inhibit lipid oxidation and plaque formation, thereby reducing the risk of heart disease.

TEA REDUCES CHOLESTEROL

A high cholesterol level in the blood also increases the risk of heart disease. Several studies have shown that both black and green tea consumption could reduce cholesterol levels.

TEA REDUCES BLOOD CLOTTING

By their aggregation, platelets (a type of cell in the blood) play a central role in blood clotting. Although essential to stop bleeding during injury, blood clotting increases the risk of coronary thrombosis. Scientific investigations have shown that tea extracts and tea polyphenols could inhibit the platelet aggregation to a certain degree, thereby reducing the risk of thrombosis (blocking of arteries by a blood clot).

TEA IMPROVES ENDOTHELIAL FUNCTION

The endothelium, or inner lining of the arteries, plays a central role in the proper functioning of arteries. Endothelial cells produce factors which affect blood flow in a vessel, coagulation of blood and also serve as a barrier that controls the diffusion of liquids and solutes between blood and vessel wall. It has been recognised that endothelial dysfunction is associated with an increased risk of cardiovascular diseases.

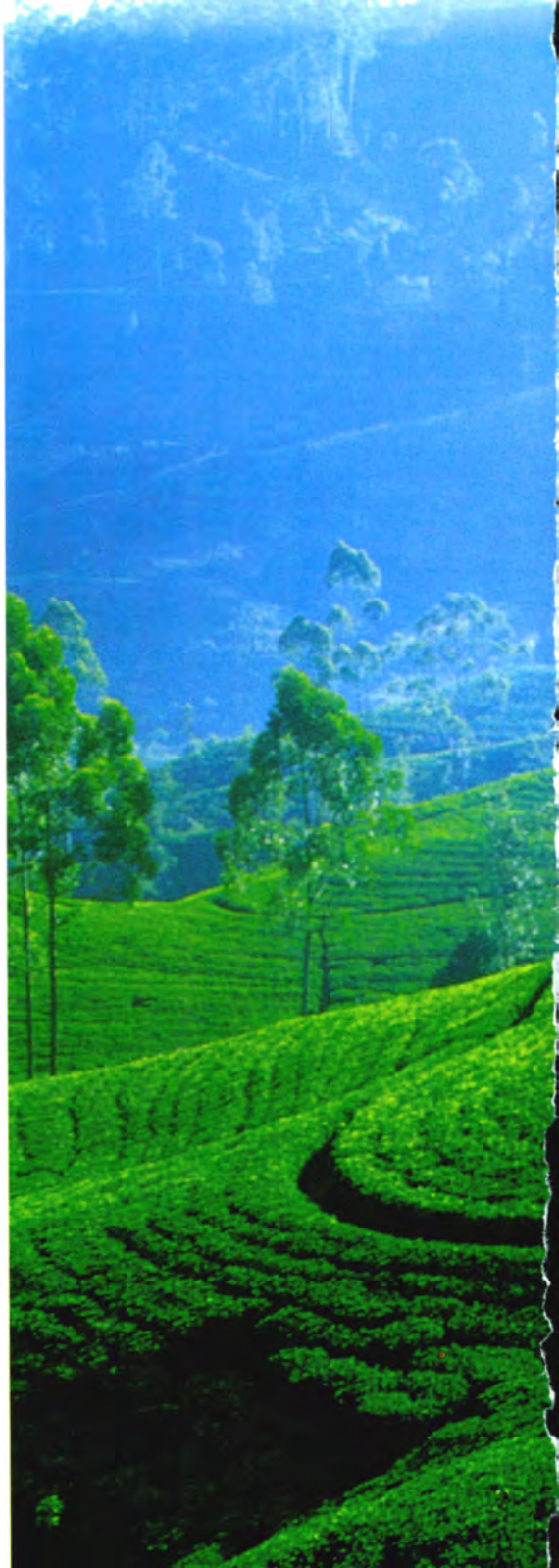
Recent scientific investigations have found that both short term and long term tea consumption improves the endothelial function, thus reducing the risk of heart disease.

POPULATION STUDIES

Epidemiological studies (the scientific study of the distribution and determinants of disease) have shown that increased polyphenol intake could reduce the incidence of heart disease. In these studies tea was identified as a major source of polyphenol intake.

The first large scale epidemiological study which clearly showed the beneficial effect of tea drinking on heart disease was carried out by Dutch scientists in 1993. They found that polyphenol intake has an inverse relationship to the incidence of myocardial infarction (heart attack). In the same study, black tea was identified as the main source of dietary polyphenol.

In recent times many other similar studies in different parts of the world have shown the beneficial effect of tea in preventing heart disease.

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Tea and Cancer

All cells in living organisms contain genetic material or DNA (deoxyribonucleic acid), which controls all activities, growth and reproduction of cells. In the initiation stage of cancer, DNA is damaged, or undergoes a change (mutation), which alters the functions of the cells it controls and may initiate their transformation into cancer cells. However, in most cases, the altered cells merely die.

In some instances DNA damage causes the rapid growth and multiplication of cells, a process called cancer initiation. Further changes facilitate the initiated cell to become a cancerous tissue. These constitute the promotional and progressive stages of carcinogenesis.

Agents that cause mutations (damage DNA) are called mutagens, and those that cause cancers are called carcinogens. Although all mutations do not progress to cancer, any agent that can damage DNA is a potential carcinogen. Certain chemicals, radiation, smoke and viruses act as carcinogens. Radiation, such as beta-rays produced in nuclear reactors, causes mutations. Ultra violet (UV) radiation is a major cause of skin cancer. Smoking has been for a long time a well-established cause of human carcinogenesis.

Scientific investigations have shown that tea polyphenols could directly react and neutralise chemical carcinogens, reducing the risk of cancer. Our body itself has enzyme systems (mainly in the liver) that act to

detoxify toxic and carcinogenic agents which enter the body. Research has found that tea increases the activity of these detoxifying enzymes. Chemical carcinogens and radiation also could produce free radicals and reactive oxygen species, which could damage the DNA, leading to carcinogenesis. Therefore, anti-oxidants in tea could act to reduce the risk of cancer.

In the promotional and progression stages, cell to cell signalling is important for the multiplication of cancerous cells. Research has revealed that tea components interfere with cell to cell signalling and reduce the promotion and progression of cancer. A good blood supply is essential for the rapid growth of the cancerous tissue. The formation of small blood vessels (angiogenesis) that provides blood to the cancer tissue is an important feature in carcinogenesis. Recent research has established that tea has anti-angiogenetic properties.

Furthermore, population studies have shown the anti-cancer properties of tea.

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Tea and Oral Health

Tooth decay is caused by bacteria that secrete acidic substances which damage the teeth. Fluoridisation of enamel (outer covering) and dentine (inner core) in teeth hardens them and makes these tissues more acid resistant. Prevalence of dental caries (decay) is inversely related to fluoride intake. Tea contains significant amounts of fluoride in an easily assimilable form. Hence, tea drinking makes a significant contribution to the daily fluoride intake and to the reduction of tooth decay.

It has been found that not only fluoride but also the polyphenols in tea could act to reduce tooth decay. Tea polyphenols could inhibit the growth of bacteria, such as *Streptococcus mutans* which cause tooth decay, and could also act to reduce the ability of bacteria to get attached to a tooth's surface, thus reducing the ability of bacteria to damage teeth.

Recent research indicates that tea could inhibit the growth of other harmful micro-organisms in the oral cavity. It has been found that brewed black tea could inhibit the oral fungal species of *Candida* by 30%. Increased populations of *Candida* in the oral cavity could cause Candidasis (oral thrush). Bacterial species cause infections in the root canal, and research has found that tea could inhibit the growth of some bacterial species that cause infections in the oral cavity. These findings demonstrate that tea drinking may improve oral health.

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Tea and Diabetes

In a healthy person blood glucose levels are maintained at a constant concentration. Insulin, a hormone secreted by cells in the pancreas, regulates blood glucose levels. After a meal, glucose levels in blood increase as glucose in digested food enters the blood stream. This leads to increased secretion of insulin into blood. Insulin stimulates liver and muscle cells to take up and metabolise more glucose, thus regulating the level of glucose in blood.

In Type 1 diabetes (insulin dependant diabetes) the pancreas does not produce the required amount of insulin to regulate blood glucose. In Type 2 diabetes (non-insulin dependant diabetes) liver and muscle cells cannot utilise the insulin produced to regulate blood glucose.

Some plant extracts contain substances which could mimic the action of insulin and help in managing Type 2, or non insulin dependant diabetes. The flavonol, myricetin, which is present in tea, is found to be able to mimic insulin activity.

The enzyme, alpha-amylase, catalyses the conversion of starch in food to glucose in the digestive process. Glucose in the digestive tract is easily absorbed into the blood stream while starch is not absorbed. Polyphenols in tea inhibit alpha-amylase activity and could contribute to reducing blood glucose levels.

These studies indicate that tea consumption could be beneficial to diabetics. Although large numbers of different types of studies have demonstrated the beneficial effects of tea on heart disease, cancer and oral health, the results of studies on tea and diabetes have emerged only recently. Thus, the significance of tea on diabetes needs to be evaluated further.

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Tea and the Immune System

The immune system is activated by foreign particles entering the body or by injury. Activation of the immune system is essential for destroying the harmful micro-organisms that enter the body and for repairing injury. The immune response could be divided into two components: specific immune response and the non specific or the inflammatory response. In specific immune response the invading pathogens are identified and the cells of the immune system act to destroy the pathogen. Inflammatory response is non specific and is triggered by any foreign body or injury. Cigarette smoke and environmental pollutants also activate the inflammatory response.

Among other things, inflammatory response produces a large amount of free radicals. Although essential in destroying harmful organisms entering the body, prolonged inflammation is harmful to the host itself as it exposes host cells to prolonged 'oxidative stress'. Inflammation plays an important role in the aetiology of degenerative diseases such as cardiovascular, neurological, rheumatological diseases and cancer. In the modern environment our body systems are exposed to prolonged oxidative stress, and anti-oxidant defences have become more important. Recent research has found that tea acts to reduce the harmful effects of inflammation by acting as anti-oxidants and by regulating the mediators of the inflammatory response. More importantly, it has been found that tea components, while not compromising the action against harmful invaders, reduce the harmful effects of inflammation.

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Tea and Intestinal Bacteria

A variety of micro-organisms live in our digestive tract. Some of the enzymes secreted from micro-flora in the intestines help to digest and metabolise compounds in food. Therefore, these micro-organisms are helpful to us, yet some other micro-organisms secrete harmful substances that predispose cells to carcinogenesis.

Consumption of tea and its polyphenols, either chronically or over a period of weeks, reduces harmful Enterobacteriaceae and increases Lactobacilli and Bifidobacteria that produce beneficial metabolites. The gradual replacement of less desirable bacteria by beneficial bacteria in the intestine is one of the beneficial consequences of drinking tea.


BT Images

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Tea and Ageing

Scientists are looking in different directions for the fountain of youth. Some believe our genes predestine us to die after a given life span and therefore rely on genetic techniques to combat the effects of ageing. Others postulate that the body's oxidative defence mechanisms deteriorate with ageing because of a genetically programmed reduction in the synthesis of natural anti-oxidants in the cells, leading to a sharp increase in the diseases of old age. They are investigating ways of slowing the rate of free radical attack in the aged.

In animals it has been shown that increased anti-oxidants could increase life span. There is growing evidence that human diet, supplemented with anti-oxidants, may help in preventing a variety of diseases such as cancer and heart diseases. However, it is not conclusively proven that anti-oxidants could extend life span. Even if it is not possible to extend the human life span by anti-oxidants, these could control cell damage and thus reduce the diseases of old age and improve the quality of life in the elderly.

Conclusions

Today the main diseases afflicting the people of the world are the degenerative diseases: heart disease, high blood pressure, stroke, cancer and diabetes. These diseases, caused at least in part by improper and unbalanced nutrition, are responsible for 50-70% of premature mortality.

Tea, as the most consumed beverage after water, has a great impact on balanced nutrition. From a myriad of scientific investigations that have been carried out, the anti-oxidant activity of tea's polyphenols emerges as the most important factor that reduces the risk of degenerative diseases.

Tea with high amounts of polyphenols could act as an inexpensive but significant part of the dietary armoury against the chronic and debilitating diseases of our modern times. It is the general polyphenolic chemical structure that has the effective anti-oxidant action against damaging free radicals. Both black tea and green tea are equally effective in preventive action.

Tea could also act to improve oral health and increase the useful microbial population in the intestine. Moreover, it acts to improve the quality of life in elderly people.

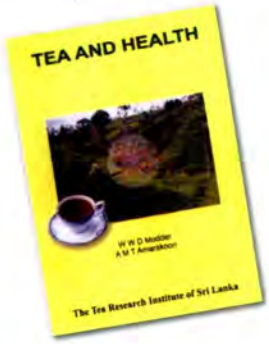
The virtual consensus of opinion of nutritionists the world over is that tea, like other foods rich in anti-oxidants, should be a component of most people's daily diet.

It is the least-expensive beverage next to water, it is easily available almost everywhere in the world, and it is a natural food, processed and

prepared without additives and preservatives. It has been time-tested by populations and civilisations over millennia, and in general, nothing but good is said about tea. Recent studies by reputable scientists establish the therapeutic value of tea. Their conclusions are based on hard evidence from research findings.

It has been a long established fact that tea is a wonderfully refreshing beverage. The findings of modern science in regard to its therapeutic value make tea the ideal drink for our times.

For further reading .....



A serious review in the best traditions of scientific writing, which has been described as "easily readable and interesting".

Tea for Health

TISSA AMARAKOON

Diseases such as heart disease, cancer and diabetes have shown increased incidence in recent times. Changes in lifestyles could prevent these diseases. Diet plays the most important role in a preventive lifestyle.

In this context, commonly consumed food products were brought under the scrutiny of global scientists in recent times and were branded as healthy or unhealthy. Results of the recent bio-medical research on tea carried out in world renowned laboratories have confirmed the age old wisdom that tea drinking improves human health.

This book gives the essence of these recent research findings in simple language.

Symbol of Quality

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