CHAPTER 1
DESIGN OF THE STUDY

1.1 INTRODUCTION

Tea is a part and parcel of Indian social, economic and cultural life. Indians cannot think of a day without their favorite cup of tea. Tea is the most popular non-intoxicating beverage in the world enjoyed by the rich and poor alike. Tea has found a permanent place in the lives and hearts of diverse people the world over, and spread cheer and camaraderie for over 4500 years. Poets and philosophers have lavished praise on it, and perhaps no other beverage has been the object of such ritual and ceremony across the planet. Today, over three billion cups of tea are consumed every day across the globe, making it the most popular and cheapest drink in the world after water. Its fragrance, flavour and gentle aroma generate a sense of pleasure, well-being and fellowship across the world, around the clock. The global market for hot beverages (coffee and tea) is forecasted to reach US$69.77 billion in value and 10.57 million tonnes in volume terms by the year 2015.1

India produces and consumes more tea than any other country in the world, except for China, including the famous Assam tea and Darjeeling tea. Despite the production, India is also the largest exporter of tea after China. Owning more than 13,000 Tea Gardens, India is one of the largest producers of Tea. Indulging the workforce of more than two millions, Tea production in India constitutes a major building block of Indian economy. The rich greenery and natural surroundings prevailing all over in East, North-East and South region of the country nourish plenty of lush green tea plantation area. The Assam Tea Garden, Darjeeling Tea Garden and Nilgiri Tea Garden are
world famous for their quality of Tea as well as the natural beauty of its Tea plantation area. Enormously found mountain region and its greenery and pleasant climate make these locations popular not only for Tea, but also for tourism.

The cultivation and brewing of tea in India has a long history of applications in traditional systems of medicine and for consumption. The practice of Ayurveda has resulted in a long standing tradition of tisanes, (an infusion - as of dried herbs – used as a beverage or for medicinal effects). Traditional Indian kitchens have long utilized the medicinal benefits offered by various plants and spices such as basil (Tulsi), cardamom (Elaichi), pepper (Kali Mirch), liquorice (Mulethi), mint (Pudina), etc., and traditionally, tisanes made with these plant leaves and/or spices have been in use for centuries for maladies ranging from the serious to the trifling. Tea also serves as a delivery vehicle for these traditional tisanes. The taste of chai (sweet and milky) helps disguise the stronger and more bitter flavours of some of the medicinal additives, while other, more pleasant flavours such as cardamom and ginger add a pleasing flavour and aroma to the tea along with health benefits.

Commercial production of tea in India did not begin until the arrival of the British East India Company, at which point large tracts of land were converted for mass tea production. The first discovery of the tea plant growing wild in India (upper Assam) was in 1821. In 1835, the first tea garden was opened at Lakhimpur District Assam. In 1838, the first twelve chests of tea from Assam were received in England. It was found that tea manufactured from Assam plants would be better than the Chinese variety.
1.2 CULTIVATION AND HARVESTING OF TEA

Tea is an evergreen plant that grows mainly in tropical and sub-tropical climates. Tea plants are propagated from seed and by cutting; it takes about 4 to 12 years for a tea plant to bear seed, and about three years before a new plant is ready for harvesting. Only the top 1 to 2 inches of the mature plant are picked. These buds and leaves are called “flushes”. A plant will grow a new flush every seven to fifteen days during the growing season, and leaves that are slow in development always produce better-flavoured teas. Tea plants require at least 127 cm (50 inches) of rainfall a year and prefer acidic soils. A tea plant will grow into a tree of up to 16 m (52 feet) if left undisturbed, but cultivated plants are pruned to waist height for ease of plucking.

1.3 PROCESSING AND CLASSIFICATION OF TEA

After picking, the tea leaves soon begin to wilt and oxidize, unless they are immediately dried. The leaves turn progressively darker as their chlorophyll breaks down and tannins are released. This enzymatic oxidation process, known as fermentation in the tea industry, is caused by the plant's intracellular enzymes and causes the tea to darken. In tea processing, the darkening is stopped at a predetermined stage by heating, which deactivates the enzymes responsible. In the production of black teas, the halting of oxidization by heating is carried out simultaneously with drying. Teas can generally be divided into categories based on how they are processed. There are different types of tea: white, yellow, green, oolong and black. Some varieties, such as traditional oolong tea and Pu-erh tea can be used medicinally.
1.3.1 Black tea

Black tea is the oxidized leaf of the tea bush. It is the same plant as green and oolong tea, but is left to oxidize longer than either of these and so has a different, generally stronger flavour and different health benefits. Black tea stores better than other types of tea and can keep its flavour for several years. Whole leaf black tea is considered the best quality, whereas broken leaves are often used in tea bags. Black tea is often mixed with other ingredients such as bergamot (orange) oil to create Earl Grey Tea, or cinnamon and other spices to create Chai tea. In many cultures, black tea is taken with milk, lemon and/or sugar or sweetener as well. Black tea contains caffeine. It has very few to no calories or nutrients, although it does contain antioxidants. Black tea should be steeped in just boiled water. While the tea in tea bags usually has a high surface area and should only be steeped for a couple of minutes, whole leaf tea can be steeped for five minutes without turning bitter.

Figure 1.1
Black tea
Black tea is used for improving mental alertness as well as learning, memory and information processing skills. Popular types of black tea include Earl Grey, English Breakfast, Assam Black Tea, Darjeeling First and Second Flush Black Teas, Lapsang Souchong Black Tea and Ceylon Black Tea. In recent years, many tea companies have started to offer more exotic and non-traditional black tea blends. These may include flavours like chocolate or vanilla, wood or smoke, tropical fruits, warming spices and dried herbs (such as mint or lavender. Black tea comprises of machine-processed CTC tea (which infuses quickly and is usually enjoyed with milk and sugar), hand-picked orthodox tea, loose-leaf tea or dust tea.

1.3.2 Green tea

A green tea extract is a herbal derivative from green tea leaves (Camellia sinensis). Containing antioxidant ingredients – mainly green tea catechins (GTC) – green tea and its derivatives are sought-after amongst people who pursue health. Typically, green tea undergoes a multi-step process of steaming, pan-firing, and/or rolling before being dried to stop the oxidation process. Little oxidation occurs in most green teas, so that they are differentiated from white teas mainly by the extra steps of processing the leaf before drying. Green teas reportedly contain the second highest concentration of antioxidants, which can neutralize dangerous free radicals in the body. The flavour of green tea ranges from grassy to sweet and has a mild astringency. Because of the high antioxidant activity of green tea extracts, they are hopefully to be used as a kind of innovative food additive to preserve pork, chicken meat, vegetable oil, fish oil and fish flesh, food emulsions and animal fat.
The bio-chemical properties of green tea extracts can be generally divided into four aspects – antioxidant, anti-carcinogen, anti-inflammatory, and anti-radiation. Green tea extracts exhibit stronger antioxidant protection for human body than vitamin C and vitamin E. It should be mentioned that from the antioxidant perspective, green tea extracts are more effective than black tea extracts due to the better preservation of catechins. In addition, green tea extract also contains a wide-range, anti-inflammatory characteristics and so it may be helpful in treating chronic inflammatory states. Green tea extracts show anti-radiation properties on white rats in radioactive isotope experiments.

1.3.3 White tea

White tea is a lightly oxidized tea grown and harvested almost exclusively in China, primarily in the Fujian province. It comes from the delicate buds and younger leaves of the Chinese Camellia Sinuses plant. These buds and leaves are allowed to
wither in natural sunlight before they are lightly processed to prevent oxidation or further tea processing. This preserves the characteristic flavour of the white tea. The name "white tea" derived from the fine silvery-white hairs on the unopened buds of the tea plant, which gives the plant a whitish appearance. The beverage itself is not white or colourless but pale yellow. Many people switch from black tea or green tea to white tea for health or taste reasons. Whereas most green and black teas are made from mature tealeaves, white tea is made entirely or mostly from the 'buds' (or immature, unopened tealeaves) of the tea plant. The buds should look white and fuzzy. This appearance is often referred to as looking 'downy' because it resembles the appearance of fine down feathers. These 'hairs' on the tea buds are a natural mechanism the white tea plant uses to protect its new tea buds from insects.

**Figure 1.3**  
**White tea**

To prepare white tea, use water that is under 190 degrees Fahrenheit and steep for three to five minutes. White tea is made from the 'buds' and sometimes the leaves of the tea plant. White tea is often described as 'minimally processed' and 'unoxidized.' It is minimally processed -- it is basically plucked and then 'withered' (exposed to low-
level warmth to reduce its water content) and dried (with sunlight or hot air). However, it is slightly oxidized during this process.

White tea producers need to have a lot of skill to make great white tea, and they have to adapt to unpredictable weather conditions to harvest and process the tea at the optimal time. There are many types of white tea available in the market. These include Silver Needle White Tea (a bud-only white tea), Bai Mu Dan / White Peony White Tea (a white tea made from leaves and buds), Darjeeling White Tea (a white tea from India), Ceylon White Tea (from Sri Lanka) and blended or flavoured white teas.

1.3.4 Pu-erh tea

Pu-erh tea, also spelled as Pu'er tea, is a variety of fermented dark tea produced in Yunnan province, China. It is traditionally prepared in the context of a ‘Gongfu’ tea ceremony, a set of practices dating back to the eighth century. The large leaves are either oxidized or left raw, however even raw, or green, puerh tea is briefly fired to stop enzymatic activity in the leaves. Puerh tea is sold as loose leaf tea or pressed into cakes and other shapes. The leaves of the oldest trees are most sought after. Correctly brewed Puerh tea has a rich, earthy flavour that is in a class of its own. It has an extremely long shelf life and, depending on the variety, may be suitable for drinking only fifty years after harvest and beyond. Properly processed, aged puerh tea from high quality trees can increase significantly in value over time. In recent years, this has led to higher prices for rarer puerh teas. However, it appears higher prices fuelled by speculation have subsided for the time being. Many medicinal properties are ascribed to puerh tea and it is believed to be suitable for people of all ages. While the tea is frequently purchased to aid in weight loss and to combat the ill-effects of
excessive alcohol consumption, studies indicate that the tea can reduce blood cholesterol.

Compressed leaves are separated from the puerh cake using a special puerh knife and one must be careful not to crush the leaves. The leaves are then combined with approximately four ounces of hot water in a small teapot made of ‘yixing’ clay, also called ‘zisha’ clay. These unglazed teapots absorb the flavours of puerh teas over time and become seasoned, enhancing the flavour of the brew. The quality of the water, the temperature of the water, and infusion time are the keys to proper preparation of puerh tea. Natural aging can take ten to thirty years and requires careful storage. Exposure of the tea to odours or direct sunlight can taint the flavour of the tea.

While Puerh Tea is predominantly pressed into cakes, an interesting variety of additional compact shaped may be used including squares, bricks, bowls, mushrooms, and melons. Most Puerh Tea is distributed in small cakes weighing about 357 grams. Regardless of the final shape, each of these forms is created by steam-moistening the ripened tea leaves to improve cohesion prior to compressing the tea into the desired form. Occasionally, cakes are made of older leaves mixed with the current year leaves. This mixing is, unfortunately, difficult to get information about, as it is considered a trade secret.

In the next step, the desired amount of tea is placed within a cloth and under the press. This compression can be preformed mechanically or by hand with a hydraulic or lever press. Traditionally, a large rock was used for the pressing. A small piece of paper called a ‘Nei fei’ will also be pressed in with the tea, as a sign of authenticity that resists easy tampering. The pressed tea must be allowed to dry prior to packaging.
and sale. When sold individually, each pressed cake will come in a cotton wrapper printed with information on the production location and year of production. These wrappers also sometimes include interesting artwork. Pu-erh tea is also sold wholesale in larger bamboo containers called ‘Tong’.

There are two major types of Pu-erh tea: "Raw Pu-erh" and "Ripe Pu-erh". These two Pu-erh types are distinguished by their respective fermentation processes. Both types of Pu-erh tea are made from freshly harvested leaves that have been wilted, either fried manually or tumbled through a heated rotating cylinder, kneaded and sun-dried in open air.

The term "Raw Pu-erh" refers to loose leaves, tea cakes or bricks made from raw materials without additional processing. Raw Pu-erh can be consumed immediately to enjoy its fresh, floral or fruity flavours, or it can be left to age in a natural environment
to achieve a mellower, smoother and more complex flavour. "Ripe Pu-erh" offers an alternative to having to wait ten to thirty years for the Raw Pu-erh to mature and achieve the aged flavour that is popular among Chinese people. In 1970's, the industry developed a method to artificially accelerate the aging process by "cooking" Pu-erh tea. This "cooking" process, called "wo dui", involves incubating the tea in a moisture-rich environment where microbial activity causes the temperature to rise, drastically intensifying the fermentation process. This process typically takes a few months to complete.

1.3.5 Oolong tea:

Oolong is a traditional Chinese tea produced through a unique process including withering under the strong Sun and oxidation before curling and twisting. Most oolong teas, especially those of fine quality, involve unique tea plant cultivators that are exclusively used for particular varieties. The degree of oxidation can range from 8 percent to 85 percent, depending on the variety and production style. This tea category is especially popular with tea connoisseurs of South China and Chinese expatriates in Southeast Asia, as is the tea preparation process that originated from this area: gongfu tea-making, or the gongfu tea infusion approach.
The taste of oolong ranges hugely amongst various sub varieties. It can be sweet and fruity with honey aroma, or woody and thick with roasted aroma, or green and fresh with bouquet aroma, all depending on the horticulture and style of production. It is semi-fermented, which gives it approximately 15 percent of the caffeine in one cup of coffee. High quality oolong can be brewed multiple times from the same leaves, and unlike green tea, it improves with reuse. It is common to brew the same leaves three to five times, the third steeping usually being the best. Customarily, the first brew is not drunk. Oolong activates an enzyme responsible for dissolving triglycerides, the form of dietary fat that is stored in fat cells.

1.3.6 Premium or delicate tea

Some teas, especially green teas and delicate oolong teas are steeped for shorter periods, sometimes less than thirty seconds. Tea strainer is used to separate the leaves
from the water at the end of the brewing time if a tea bag is not being used. However, the black Darjeeling tea, a premium Indian tea, needs a longer than average steeping time. Elevation and time of harvest offer varying taste profiles; proper storage and water quality also have a large impact on taste.

**Figure 1.6**

Premium or delicate tea

1.4 BLENDING AND ADDITIVES OF TEA

Blending may occur in the tea-planting area where teas from many areas may be blended. The aim of blending is to obtain better taste, higher price or both, as a more expensive, better-tasting tea may cover the inferior taste of cheaper varieties. Some teas are not pure varieties, but have been enhanced through additives or special processing. Tea is highly receptive to inclusion of various aromas; this may cause
problems in processing, transportation, and storage, but also allows for the design of an almost endless range of scented and flavoured variants, such as bergamot, vanilla, and caramel

**1.5 COMPONENTS OF TEA**

**1.5.1 Caffeine**

Caffeine content in black tea is around 3 to 4 percent of dry weight. It has stimulating property and removes mental fatigue. The contribution of caffeine to the infusion is the briskness and creamy property resulting from the complex formed by caffeine with polyphenols. Briskness is the taste and sensation while creaming is the turbidity that develops from a good cup of tea when cooled.

**1.5.2 Tea fibre**

The leaf cell wall, containing cellulosic materials surrounded by hemi-cellulose and a lignin seal, prevents the penetration of hydrolyzing enzymes. The reduced succulence in the matured shoot is believed to be due to structural bonding between phenol components of lignin, polysaccharides and cetin of cell wall.

**1.5.3 Carbohydrates**

The free sugars found in tea shoot are glucose, fructose, sucrose, raffinose and stachyose. Maltose in Assam variety and Rhamnose in china variety are special in character. Pectic substances contain galactose, arabinose, galacturonic acid, rhamnose and ribose. Free sugars are responsible for the synthesis of catechins in tea shoot, formation of heterocyclic flavour compounds during processing of black tea and
contributing towards water-soluble solids in tea liquor. Cellulose, hemi-cellulose, pectin and lignin are responsible for the formation of crude fibre content in black tea.

Tracer studies using 14C-glucose in detached tea shoot showed that glucose was one of the precursors of polyphenols in tea. Except theanine, all amino acids present in tea shoot were bio-synthesized using 14C-glucose, 14C-sodium carbonate and 14C-sodium propionate. Theanine was mainly synthesized in the root and trans-located to the shoot.

1.5.4 Amino acids

Aspartic, glutamic, serine, glutamine, tyrosine, valine, phenylalanine, leucine, isoleucine and theanine (5-N-ethylglutamine) were found to be the principal amino acids present in tea leaf. Theanine alone contributed around 60 percent of total amino acid content. Asparagine was formed during withering. The amino acids play an important role in the development of tea aroma during the processing of black tea.

Volatile Carbonyl Compounds formed from the amino acids during processing are:

\[
\begin{align*}
\text{Glycine} & \rightarrow \text{formaldehyde} \\
\text{Alanine} & \rightarrow \text{acetaldehyde} \\
\text{Valine} & \rightarrow \text{isobutyraldehyde} \\
\text{Leucine} & \rightarrow \text{isovaleraldehyde} \\
\text{Isoleucine} & \rightarrow \text{2-methylbutanol} \\
\text{Methionine} & \rightarrow \text{methional} \\
\text{Phenyl alanine} & \rightarrow \text{phenylacetaldehyde}
\end{align*}
\]

1.5.5 Lipids and fatty acids

The neutral, glyco and phospholipid contents and their fatty acid composition varied in Assam, China and Cambod varieties and also during different stages of black tea manufacture. Total lipid contents (%) and total fatty acids (¹g/g) at different stages
i.e. green leaf, withered leaf, rolled leaf, fermented leaf and black teas are about 6.5, 5.7, 4.5, 4.3 and 2.8 and 9.8, 8.4, 6.6, 4.8 and 3.7 respectively. The major fatty acids available in tea are linolenic, linoleic, oleic and palmitic.

1.5.6 Carotenoids

The four major carotenoids, B-carotene, lutein, violaxanthine and neoxanthine were estimated spectroscopically in four different Tocklai released clones, namely, TV-1 (China hybrid), TV-2 (Assam Betjan variety), TV-9 (Assam-Cambod variety) and TV-17 (China hybrid). The quantitative changes of these carotenoids in different stages of black tea manufacture were also studied in TV-2 (less flavoury) and TV-17 (flavoury) clones against TV-1 as standard. Comparative study showed that TV-2 contained the least amount of these carotenoids whereas TV-9 and TV-17 contained higher amounts. All these carotenoids were found to decrease appreciably during black tea manufacture. The decrease was found to be higher in curling, tearing and crushing method than in the conventional orthodox method of tea manufacture. The changes of two of these carotenoids viz. -carotene and lutein were not significant statistically during withering but were highly significant during fermentation. However, the reverse was true for violoxanthine where as the neoxanthine shows significant changes in both of these stages. The vitamin A value was calculated from the residual -carotene amount, pro-vitamin A, in black tea.

1.5.7 Anthocyanidins

Delphenidin and cyanidin were the major anthocyanidins present in tea leaf. Anthocyanin contents were higher in tea shoots from pruned than those of unpruned
bushes. Role of anthocyanins on the quality of black tea however, has not been found to be significant.

1.5.8 Organic acids

Citric, tartaric, malic, oxalic, fumaric and succinic acids were detected in Assam leaf. Role of organic acids towards the bio-chemical influence on the quality of black tea is not yet reported.

Table 1.1
Bio-chemical compounds of tea responsible for colour

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Compounds</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Theaflavins</td>
<td>Yellowish brown</td>
</tr>
<tr>
<td>2.</td>
<td>Thearubigins</td>
<td>Reddish brown</td>
</tr>
<tr>
<td>3.</td>
<td>Flavonol glycosides</td>
<td>Light yellow</td>
</tr>
<tr>
<td>4.</td>
<td>Pheophorbide</td>
<td>Brownish</td>
</tr>
<tr>
<td>5.</td>
<td>Pheophytin</td>
<td>Blackish</td>
</tr>
<tr>
<td>6.</td>
<td>Carotene</td>
<td>Yellow</td>
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</tbody>
</table>

Table 1.2
Bio-chemical compounds of tea responsible for taste

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Compounds</th>
<th>Taste</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Polyphenol</td>
<td>Astringent</td>
</tr>
<tr>
<td>2.</td>
<td>Amino acids</td>
<td>Broth</td>
</tr>
<tr>
<td>3.</td>
<td>Caffeine</td>
<td>Bitter</td>
</tr>
<tr>
<td>4.</td>
<td>Theaflavins</td>
<td>Astringent</td>
</tr>
<tr>
<td>5.</td>
<td>Thearubigin</td>
<td>Ashy and slight astringent</td>
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</tbody>
</table>
Table 1.3  
**Bio-chemical compounds of tea responsible for flavour**

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Compounds</th>
<th>Flavour</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Linalool, Linalool oxide</td>
<td>Sweet</td>
</tr>
<tr>
<td>2.</td>
<td>Geraniol, Phenylacetaldehyde</td>
<td>Floral</td>
</tr>
<tr>
<td>3.</td>
<td>Nerolidol, Benzaldehyde, Methyl salicylate, Phenyl ethanol</td>
<td>Fruity</td>
</tr>
<tr>
<td>4.</td>
<td>Trans-2-Hexenal, n-Hexanal, Cis-3-Hexenol, Grassy, b-Ionone</td>
<td>Fresh flavour</td>
</tr>
</tbody>
</table>

Table 1.4  
**Principal components of black tea**

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Components</th>
<th>Concentration (g/100g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Catechins</td>
<td>3.0</td>
</tr>
<tr>
<td>2.</td>
<td>Theaflavins</td>
<td>3.0</td>
</tr>
<tr>
<td>3.</td>
<td>Thearubigins</td>
<td>12.0</td>
</tr>
<tr>
<td>4.</td>
<td>Flavanols</td>
<td>6.0</td>
</tr>
<tr>
<td>5.</td>
<td>Phenolic acids and Depsides</td>
<td>10.0</td>
</tr>
<tr>
<td>6.</td>
<td>Amino acids</td>
<td>13.0</td>
</tr>
<tr>
<td>7.</td>
<td>Methylxanthines</td>
<td>8.0</td>
</tr>
<tr>
<td>8.</td>
<td>Carbohydrates</td>
<td>10.0</td>
</tr>
<tr>
<td>9.</td>
<td>Protein</td>
<td>0.8</td>
</tr>
<tr>
<td>10.</td>
<td>Mineral matter</td>
<td>8.0</td>
</tr>
<tr>
<td>11.</td>
<td>Volatiles</td>
<td>0.05</td>
</tr>
</tbody>
</table>
1.6 HEALTH EFFECTS OF DRINKING TEA

Tea contains a large number of potentially bioactive chemicals, including flavinoids, amino acids, vitamins, caffeine and several polysaccharides, and a variety of health effects have been proposed and investigated. It has been suggested that green and black tea may protect against cancer, though the catechins found in green tea are thought to be more effective in preventing certain obesity-related cancers such as liver and colorectal while both green and black tea may protect against cardiovascular disease. Numerous recent epidemiological studies have been conducted to investigate the effects of green tea consumption on the incidence of human cancers. These studies suggest significant protective effects of green tea against oral, pharyngeal, esophageal, prostate, digestive, urinary tract, pancreatic, bladder, skin, lung, colon, breast, and liver cancers, and lower risk for cancer metastasis and recurrence. Preliminary lab studies shows that a wide variety of commercial teas appear to either inactivate or kill viruses.

1.6.1 Tea reduces risk of heart attack and stroke.

Unwanted blood clots formed from cholesterol and blood platelets cause heart attack and stroke. Drinking tea may help keep your arteries smooth and clot-free, the same way a drain keeps the bathroom pipes clear. A study from Netherlands found a seventy percent lower risk of fatal heart attack in people who drank at least two to three cups of black tea daily compared to non-tea drinkers.

1.6.2 Tea protects bones

It is not just the milk added to tea that builds strong bones. One study that compared tea drinkers with non-drinkers, found that people who drank tea for ten or more years
had the strongest bones, even after adjusting for age, body weight, exercise, smoking and other risk factors.

1.6.3 Tea bolsters immune system.

Drinking tea may help the immune system of human body to fight off infection. When 21 volunteers drank either five cups of tea or coffee each day for four weeks, researchers saw higher immune system activity in the blood of the tea drinkers.6

1.6.4 Tea increases metabolism.

Lots of people complain about a slow metabolic rate and their inability to lose weight. Green tea has been shown to actually increase metabolic rate so that one could burn 70 to 80 additional calories by drinking just five cups of green tea per day or inactivate the virus within a few minutes..

1.6.5 Atherosclerosis

Clinical studies prove that the antioxidant properties of tea help to prevent atherosclerosis, particularly coronary artery disease by lowering cholesterol and triglyceride levels. In fact, researchers estimate that the rate of heart attack decreases by 11 percent with consumption of three cups of tea per day.

1.6.6 High cholesterol

Research shows that green tea lowers total cholesterol and raises HDL cholesterol in both animals and people. A clinical study found that men who drink tea are more likely to have lower total cholesterol than those who do not drink tea. Results from an animal study suggest that polyphenols in green tea may block cholesterol from being absorbed in the intestine and also help the body get rid of cholesterol.
1.6.7 Tea protects against cancer.

Several population-based clinical studies have shown that drinking tea helps to prevent cancer. Several clinical studies suggest that the polyphenols in tea, especially green tea, may play an important role in the prevention of cancer. Researchers also believe that polyphenols help kill cancerous cells and stop them from growing. A few clinical studies have examined the relationship between bladder cancer and drinking tea. In a study of 472 women with various stages of breast cancer, researchers found that women who drank tea had the least spread of cancer. It was especially true in premenopausal women in the early stages of breast cancer. They also found that women with early stages of the disease who drank at least five cups of tea every day before being diagnosed with cancer were less likely to have the cancer come back after they finished treatment. In a clinical study done with ovarian cancer patients in China, researchers found that women who drank at least one cup of tea per day lived longer with the disease than those who did not drink green tea.

In a large-scale clinical study researchers compared green tea drinkers with non-drinkers and found that those who drank the most tea were less likely to develop pancreatic cancer. Laboratory studies have found that green tea extracts prevent the growth of prostate cancer cells in test tubes. In a large clinical study in Southeast China, researchers found that the risk of prostate cancer went down with increasing frequency, duration and quantity of tea consumption. Furthermore, research reveals that when compared green tea drinkers with non-drinkers, people who drank tea were about half as likely to develop stomach cancer and stomach inflammation as those who did not drink green tea.
1.6.8 Tea controls diabetes

Tea has been used traditionally to control blood sugar levels. Several studies suggest that green tea may help prevent the development of Type 1 diabetes and slow the progression once it has developed. In people with Type 1 diabetes, their bodies make little or no insulin, which helps convert glucose or sugar into energy. Green tea may help regulate glucose in the body. A few small clinical studies have found that taking a green tea extract daily lowered the haemoglobin A1c level in people with borderline diabetes.

1.6.9 Liver disease

Population-based clinical studies have shown that men who drink more than ten cups of green tea per day are less likely to develop liver problems. Tea also seems to protect the liver from the damaging effects of toxic substances such as alcohol. Animal studies have shown that green tea helps protect against liver tumours in mice. Results from several animal and human studies suggest that one of the polyphenols in green tea, known as catechin, may help treat viral hepatitis, an inflammation of the liver.

1.6.10 Weight loss

Clinical studies suggest that green tea extract may boost metabolism and help to burn fat. A study found that the combination of green tea and caffeine improved weight loss and maintenance in people who were overweight and moderately obese. Some researchers think that substances in green tea known as catechins are responsible for the herb's fat-burning effect.
1.7 TEA CULTURE

Tea may be consumed early in the day to heighten alertness; it contains theophylline and bound caffeine. Decaffeinated brands are also sold. While tea is the second most consumed beverage on Earth after water, in many cultures it is also consumed at elevated social events, such as afternoon tea and the tea party. Tea ceremonies have arisen in different cultures, such as the Chinese and Japanese tea ceremonies, each of which employs traditional techniques and ritualized protocol of brewing and serving tea for enjoyment in a refined setting. One form of Chinese tea ceremony is the Gongfu tea ceremony, which typically uses small Yixing clay teapots and oolong tea.

Ireland has, for a long time, been one of the biggest per-capita consumers of tea in the world. The national average is four cups per person per day, with many people drinking six cups or more. Tea in Ireland is usually taken with milk and/or sugar and is slightly spicier and stronger than the traditional English Blend. The two main brands of tea sold in Ireland are Lyons and Barry's. Tea is prevalent in most cultures in the Middle East. In Arab culture, tea is a focal point for social gatherings.

In Pakistan, both black and green teas are popular and are known locally as ‘Sabz Chai’ and ‘Kahwah’, respectively. The popular green tea called ‘Kahwah’ is often served after every meal in the Pashtun belt of Baluchistan and in Khyber Pakhtunkhwa, which is where the Khyber Pass of the Silk Road is found. In the Kashmir region, ‘Kashmiri Chai’ or ‘Noon Chai’’, a pink, milky tea with pistachios and cardamom, is consumed primarily at special occasions, weddings, and during the winter months when it is sold in many kiosks. In Central and Southern Punjab along
with metropolitan Sindh, tea with milk and sugar, commonly referred as ‘Chai’, is widely consumed. It is the most common beverage of working class and households. In the northern Pakistani regions of Chitral and Gilgit-Baltistan, a salty, buttered Tibetan-style tea is consumed. In Iranian culture, tea is widely consumed and is generally the first thing offered to a household guest.

In United States of America and Canada, 80 percent of tea is consumed cold, as iced tea. Sweet tea is a cultural symbol of the southern United States and is common in that portion of the country. Switzerland has its own unique blend of iced tea, made with the basic ingredients like black tea, sugar, lemon juice and mint, but a variety of Alp herbs are also added to the concoction. Apart from classic flavours like lemon and peach, exotic flavours like jasmine and lemongrass are also very popular.

In India, tea is one of the most popular hot beverages. It is consumed daily in almost all homes, offered to guests, consumed in high amounts in domestic and official surroundings, and is made with the addition of milk with or without spices. It is also served with biscuits. More often than not, it is drunk in "doses" of small cups (referred to as "Cutting" chai if sold at street tea vendors) rather than one large cup. On April 21, 2012, the Deputy Chairman of Planning Commission (India), Montek Singh Ahluwalia, said that tea would be declared as national drink by April 2013. The move is expected to boost the tea industry in the country. Speaking on the occasion, the Assam Chief Minister Tarun Gogoi said that a special package for the tea industry would be announced in the future to ensure its development.

In the United Kingdom, it is consumed daily and often by a majority of people across the country, and indeed is perceived as one of Britain's cultural beverages. In
British homes, it is customary good manners for a host to offer tea to guests soon after their arrival. Tea is generally consumed at home; outside the home in cafés. Afternoon tea with cakes on fine porcelain is a cultural stereotype, sometimes available in quaint tea-houses. In southwest England, many cafes serve a 'cream tea', consisting of scones, clotted cream, and jam alongside a pot of tea. Throughout the United Kingdom, 'tea' may also refer to the evening meal.

In Burma (Myanmar), tea is consumed not only as hot drinks, but also as sweet tea and green tea known locally as ‘lappet-yay’ and ‘lappet-yay-gyan’, respectively. Pickled tea leaves, known locally as ‘lappet’, are also a national delicacy. Pickled tea is usually eaten with roasted sesame seeds, crispy fried beans, roasted peanuts and fried garlic chips.

1.8 MAJOR TEA GROWING REGIONS IN INDIA

There are a number of tea growing regions spread all over India, some of which are world famous. Tea plantations in India are mainly located in rural hills and backward areas of North-eastern and Southern States. Major tea growing areas of the country are concentrated in Assam, West Bengal, Tamil Nadu and Kerala. The other areas where tea is grown to a small extent are Karnataka, Tripura, Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Manipur, Sikkim, Nagaland, Meghalaya, Mizoram, Bihar and Orissa. India produces both CTC (Crush, Tear, Curl) and Orthodox teas in addition to green tea. The weightage lies with the former due to domestic consumers’ preference. Orthodox tea production is balanced basically with the export demand. Production of green tea in India is small. The competitors to India in tea export are Sri Lanka, Kenya, China, Indonesia and Vietnam.
1.8.1 Assam

Assam is a high plateau in northern India which straddles the Brahmaputra river, is the largest tea-growing region in the world. The rivulets, lush green forests, grassland and fertile soil, all contribute to making Assam the golden tea basket. Apart from China, Assam is the only place in the world that can boast of a native tea plant (Camellia Assamica). Unlike Darjeeling tea, the Assam tea is generally grown in the plains and is widely known for a strong and malty flavour. Assam produces green and white teas in small quantities apart from the ever-popular black tea. The important tea growing areas include Chasla, Mai, Pushkowa, Madarihat, Nagrakata, Jainti Kartick and Kumargram.

The Assam variety tea is a black tea known for its brisk body, dark colour and strong flavour. The black tea of Assam is blended with other teas and sold as breakfast teas (English breakfast tea, Irish breakfast tea and Scottish breakfast tea are some of the commercial names). The Surma Valley lies in Cachar district of Assam. It produces about 5 per cent of the total tea production of the country. The Surma Valley Teas Gardens are scattered over small mounds (teelas or bheels) along the Surma river and its tributaries.

Tea is grown in the lowlands of Assam, in the rich alluvial soil of Brahmaputra River valley. There are a number of tea estates which not only cultivate tea but also host tea lovers and travellers. The first harvest of the year starts in February after a prolonged harvest break. This first flush harvest in Assam has a fragrant, fresh, flowery – and slightly spicier – character than its Darjeeling equivalent, and is a bright, golden yellow in the cup. But the very best, highest-grade, Assam teas are
harvested in May-June, during the second flush harvest period. Then the leaves release that full, spicy, malty character that is so true to form. The colour is now a rich coppery red to deep brown in the cup.

The plucking of tea during the rainy season is more productive from July to October, when the powerful monsoon rains from the Indian Ocean fall on the fertile ground. Then the quality decreases sharply and the leaves lose their spice, malty flavour and strength. Almost all Assam teas can be enjoyed with white candy sugar, preferably a “Kluntje” (a white rock candy sugar lump). The Assam Second Flush can be enhanced with a dash of fresh cream. The Assam Second Flush Broken is used as the basis for many tea blends, especially the much-loved East Frisian blend.

1.8.2 Himachal Pradesh

Himachal Pradesh is a petite hilly State in northern India and is one of India's most stunning States attracting a large number of tourists every year. The State is also a major tea-producing region in India. The Kangra region in Himachal Pradesh was first introduced to tea in 1849, by means of a Chinese hybrid plant. Light green tea is largely produced in the Kangra Valley of Himachal Pradesh. The Kangra tea region lies in the Himalayan State of Himachal Pradesh, at an average altitude of 4000 metres above sea level. The Kangra tea is world famous for its rich aroma and mild flavour. There are a number of tea estates in the Kangra region, which offer tea lovers an opportunity to experience firsthand, cultivation and production of tea.

1.8.3 Darjeeling

Darjeeling, located in the West Bengal State, on the southern slopes of the Himalayas in northeast India, is unquestionably the tea region par excellence.
Dr. Arthur Campbell (1805-1874), a surgeon in the Indian Medical Service, was the first person to plant tea in Darjeeling. Dr. Campbell became superintendent of a Sanatorium in Darjeeling in 1839, when he was transferred from his post in Nepal to India. Dr. Campbell brought tea seeds from the Kumaun region of China with him to his post in Darjeeling and he began experimenting with growing tea at his residence. Several other people began experiments with growing and cultivating tea in Darjeeling, and tea growing as an industry soon developed. Darjeeling is the most sought-after tea in India and though exorbitantly priced, it makes for an interesting and valued gift or souvenir. It is often referred to as the champagne of tea due to its extraordinary flavour and quality. Darjeeling tea is usually made as black tea. Besides, White and Oolong teas are also available. But Green tea can be found occasionally at the place.

The two main contributors to Darjeeling’s economy are Tourism and Tea Industry. Around 25 percent of India’s total Tea output comes from Darjeeling. The Happy Valley Tea Estate, at 2,750 meters above sea level, is one of the highest Tea gardens in the world, and known for growing some of the finest Tea in Darjeeling.14

Darjeeling grows and manufactures some of the finest, most aromatic varieties of tea on the planet. The most precious of the world’s teas are cultivated in the breathtaking landscape around the small city of Darjeeling. Many of the tea gardens solicit the same respect as the top vineyards of France. Without the shadow of a doubt, this area, nestled high up in the Himalayas, produces the finest, most aromatic teas in the world.
Darjeeling teas are cultivated at splendid altitudes of 800–2000 meters, and it is the highest tea gardens that usually produce the best quality tea. Although the region has just the right climatic conditions for cultivating fine tea bushes, much depends on how the complex processing is managed. The key to “tea-care” at this stage is the care that tea gardens take to ensure the well-being of their workers. A tea garden is organized like a township. The employees of the garden (on average, 900–2000 numbers) live with their families within the tea garden. Facilities such as housing, hospitals, and schools are available and the services of these social facilities are free of charge for the family members. From November until March, tea production is at a standstill. But when the mountain sun awakens the first shoots in March, harvesting begins, and the first flush is processed within 4 to 6 weeks. A good first flush tastes delicate, flowery-fresh and has a fine tangy flavour. At the beginning of the season, the daily production can reach 125 to 150 kilograms of processed tea. During the course of the year, the production levels increase considerably. The first flush is always a gamble for any Tea Garden. In early April, depending on the weather, the “in between” seasonal leaves are harvested. They integrate some of the character of the first flush while foretelling the highly aromatic, nutty, strong second flush harvested from the end of May until the end of June. The colour in the cup is a yellowish russet brown. After the second flush season, the big monsoon season begins. This harvest (July–September) is productive, but not always of the best quality. However, in October, after the rainy season, “excellence” in tea takes precedence once again. Autumn teas are typically characterized by light aroma and very pleasant flavour.
1.8.4 Sikkim

The Government of Sikkim, established Temi Tea Garden in Ravangla (27.2367°N 88.4222°E) in 1969 and it is the only tea garden in this tiny State of India. The Garden covers an area of 177 hectares (440 acres). The tea cultivated and produced here is one of the best on the world and is mostly exported abroad (under the brand name temi tea). In fact, the tea produced here has earned the highest bids for tea ever, when auctioned at the Kolkata tea auction centre (which sets international tea trading rates for whole of India). It is the only tea garden in Sikkim and considered as one of the best in India and in the world.\textsuperscript{15} The garden is laid over a gradually sloping hill. The tea produced in this garden is partly marketed under the trade name “Temi Tea”. The annual tea production of the Estate is on an average about 100 tonnes. The estate functions under a Tea Board set up by the Government of Sikkim and under its aegis the ‘Sang-Martam Tea Growers' Cooperative Society’ has been established to promote growing of different varieties of quality tea.\textsuperscript{16}

1.8.5 Nilgiris

The Nilgiri Mountains (also known as the Blue Mountains) situated in South India is a popular spot sheltering numerous beautiful tea gardens. It has a cool and moist climate. Tea is grown here at elevations of between 1,000 to 2,500 meters. Tea has been grown in Nilgiris for more than 100 years and is the most important industry of the region. In 1854 Mann was the first planter to manufacture Nilgiri teas. He started a tea plantation called Coonoor Tea Estate. Around this time, another planter, Rae, set up Dunsandle Estate near. The hilly landscape of Nilgiris, unlike Darjeeling grows Tea plants all over the year. Places like Ooty, Coonoor and Kotagiri of Nilgiri region
are not only famous for their flavoured Teas, but also for the beautiful hill stations. Some of the popular tea estates in Nilgiri include Tiger Hill, Corsley, Craigmore, Pascoes Woodlands, Colacumby, Nonsuch, Dunsandale, Chamraj, Parkside, and Glendale. Nilgiri teas are often referred to as 'The Fragrant Ones'. The best Nilgiri tea has excellent body and flavour, quite unique in the world of tea. The flavour of the Nilgiri tea is the result of the higher elevation at which they are grown.

Tea plantations in Nilgiri District typically own and operate their own processing factories. Small growers sell their tea as green leaf to "bought leaf factories", which are independently owned. After processing, it is sold through regularly scheduled auctions in Coonoor, Coimbatore and Kochi. More than fifty percent of Nilgiri tea is exported, and usually finds its way into blends used for tea bags.

1.8.6 Munnar

Munnar, in Kerala State is an attractive destination with the world's best and renowned tea estates. There are more than thirty tea estates in and around Munnar. Among them, most of the plantations are taken over by the Tata's Group Kannan Devan Tea Estate. Some of the major Tea Estates in Munnar include Harrison Malayalam, AVT Tea, Michael's tea, Brooke Bond and Tata Tea. Munnar is a Town in Kerala which was developed by the British as a vacation destination, a place to visit in order to get away from the heat of the valleys and plains located at lower elevations. It is a hill station located in the Western Ghats mountain range in the Idukki District of Kerala.

Several tea plantations (tea estates) are located in and around Munnar. The area is popular as a tourist destination. Tourists may stay at one of the many Hotels in
Munnar or, if they are lucky, find accommodations in a guest house on one of the Tea Plantations. Until 1790, Munnar and the surrounding area were forests covered, when they were first recognized by the European known as Duke of Wellington. Later in the year 1870, a subordinate of the Ruler of Travancore, leased 588 square kilometres of land to a Scottish tea planter named J.D. Munro, who was the lawyer of the Travancore Government. The first tea sapling was planted by A.H. Sharp at Parvathi, which is currently the part of Sevenmullay Estate. Presently the whole area is covered by the miles and miles of lush tea gardens, owned by various private companies.

1.8.7 Waynad

Waynad a lush mountainous agricultural area of Kerala, also produces a significant amount of tea (in addition to coffee and spices). Most of the tea plantations are located south of Kalpetta. The Parisons Group has acquired four tea plantations in Wayanad District, Kerala. The tea plantations include four estates namely Chirakkara, Thalapuzha, Jessie and Tatamala with a total extent of 4025 acres. The river Mananthavady meanders through the Estates and joins the river at Panamaram to become the mighty Kabini. The lush green tea fields border Kodagu in Karnataka and are surrounded by forested hills, which are the home to several wildlife. Elephants are a common sight as are Bisons, deer and wild boar. Opened in 1876, by the English Cooperative Society and the Scottish Cooperative Society, the fields were planted with select China and Assam hybrid varieties of teas. Visible even now are the mining shafts, where once gold was explored. Blessed with the mist from the surrounding mountains, the teas are mild with a clean fragrance and medium toned biscuit notes. Under the new, young and dynamic management, the Estates are now armed with the latest technology in replanting and rejuvenating the old tea bushes. The factories have
been revamped to include the new and latest machinery available in the industry. One tea factory produces only select mild and orthodox tea for export whereas the other factory produces the strong CTC teas preferred by mainly the domestic and neighboring markets.

1.9 PRODUCTION OF TEA IN INDIA

India is the second largest producer of tea, though over seventy percent of the tea is consumed within India itself. It has six lakh hectares of land under tea cultivation in different parts of the country, producing about 950 million kilograms of tea each year. The Indian tea industry has grown to own many global tea brands, and has evolved to one of the most technologically equipped tea industries in the world. Tea production, certification, exportation, and all other facets of the tea trade in India is controlled by the Tea Board of India.

Indian tea comes from three main areas. In the north-east, lie the lowlands of Assam and the precipitous heights of Darjeeling and in the south, lies the Nilgiri range or Blue Mountains. Assam is the largest tea-producing region in India. Almost 45 percent of India's tea comes from Estates that have been planted in the great valley of the Brahmaputra River. The finest teas come from the second flush, which lasts roughly from mid-May till the end of June. Production continues to the end of November/early December, but the quality diminishes as the crop increases during the rains. Darjeeling is on the northern edge of West Bengal where tea is grown at heights of 1,000 to 2,000 metres on Estates that cling to the foothills of the Himalayas. The two main quality flushes come in March to April and mid May to mid-June, with production continuing through the monsoon to the end of year.
Most tea from South India is produced in Tamil Nadu and Kerala, with the hill station of Ootacamund or “Ooty”.

Labour cost is the largest cost overhead accounting for about sixty percent of the total cost of production of Indian tea because the tea plantations are not just economic production units, but rather social institutions, which controls the lives of their resident work force to a large extent. Apart from employment, the plantations are also responsible for providing house, water, welfare and many other facilities that affect the daily lives of the workers. This is because most of the employees come from socially and economically weaker sections of the society and majority of employees are women who work and reside in an ideal industrial community. Their livelihood is directly linked with the prosperity of the tea industry. Therefore, the tea industry must grow, not only to fulfil its primary function of producing a wholesome beverage for domestic and overseas consumers, but also to fulfil its social obligations in sustaining and improving the well being of all those who are dependent on its fortunes. India has been a dominant player in the global tea industry. Despite its fluctuating situation in the share of world exports, still India is a key source for tea as well as the largest market.

India was the top producer of tea for nearly a century, but recently China has overtaken India as the top tea producer due to increased land availability. Today Indian Tea Industry is having 1692 registered tea manufacturers, 2200 registered tea exporters, 5548 number of registered tea buyers and nine tea auction centres. Indian tea companies have acquired a number of iconic foreign tea enterprises including British brands viz., Tetley and Typhoo. From Rs 19,500 crores in 2011, the total
turnover of the Indian tea industry is expected to be Rs 33,000 crores by 2015 according to the ASSOCHAM Report of 2011.

In general, even though India leads the world in tea technology, the methods employed to harvest the crop vary with the type of tea and terrain. Fine-leaf tea is hand plucked, and hand shears are used on mountain slopes and in other areas where tractor-mounted machines cannot go. A skilled worker using hand shears can harvest between 60 to 100 kilograms of tea per day, whereas machines cut between 1,000 and 2,000 kilograms. The latter, however, are usually applied to low grade teas that often go into teabags. The tea waste from processing is used to produce caffeine for soft drinks and medicine.

Tea was declared as the ‘State Drink’ of Assam by Chief Minister Tarun Gogoi on November 22, 2012 at the World Tea Science Congress held in upper Assam’s Jorhat Town on the occasion of hundred years celebration of Tocklai Experimental Station of the Tea Research Association.

**Top tea producing companies in India**

- Arcuttipore Tea Co Ltd
- Asian Tea & Exports Ltd
- Assam Co India Ltd
- Assambrook Ltd
- B&A Ltd
- Bansal Tea Products Pvt. Ltd
- Beeyu Overseas Ltd
- Bengal Tea & Fabrics Ltd
- Bombay Burmah Trading Co
- Brooke Bond
- Dhunseri Petrochem & Tea Ltd
- Diana Tea Co Ltd
- Godrej Tea
- Goodricke Group Ltd
- Goodwyn Tea
• Hanuman TEA Co Ltd
• Harrisons Malayalam Ltd
• Jay Shree Tea & Industries Ltd
• Jiya Gold Tea
• Jolly Merchandise Ltd
• Joonkotlee Tea & Industries Ltd
• Kamala Tea Co Ltd
• Lintas Mercantile Ltd
• Lipton Tea
• Longview Tea Co Ltd
• Maheshwari Tea Company Pvt. Ltd.
• McLeod Russel India Limited
• Mohani Tea Leaves Pvt. Ltd.
• Neelamalai Agro Industries Ltd
• Organic India
• Peria Karamalai Tea & Produce Co Ltd
• Rossell India Ltd
• Sentinel Tea & Exports Ltd
• T&I Global Ltd
• Tata Global Beverages Ltd
• Tata Tea Limited
• Terai TEA Co Ltd
• Tezpore Tea Co Ltd
• Tyroon Tea Co Ltd
• Unilever brands
• United Nilgiri Tea Estates Co Ltd
• Universal Prime Aluminium Ltd
• Warren Tea Ltd
• Wagh Bakri
Table 1.5
Production of tea in India

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Year</th>
<th>Total production in India (in million kilograms)</th>
<th>Share percentage of total production</th>
<th>Total World production (in million kilograms)</th>
<th>Share percent of India in World production</th>
<th>Percentage Increase / Decrease</th>
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</thead>
<tbody>
<tr>
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<td></td>
<td>North India</td>
<td>Increase / Decrease</td>
<td>South India</td>
<td>Increase / Decrease</td>
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<td>+152.6</td>
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<td>-3.3</td>
<td>1115.7</td>
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</table>

Source: The United Planters’ Association South India
Note: (+) indicates increase and (-) indicates decrease in amount
Figure 1.7
Production of tea in India

<table>
<thead>
<tr>
<th>Year</th>
<th>All India</th>
<th>North India</th>
<th>South India</th>
</tr>
</thead>
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<tr>
<td>2002</td>
<td>838.5</td>
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<td>2011</td>
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<td>875.6</td>
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</tbody>
</table>
Though the production of tea in India showed a decreasing trend from 2008 to 2010, there is remarkable increase in 2011. Propelled by small tea growers, the Indian tea industry has finally crossed one billion kilograms production of tea in 2011. The feat came to light following a major exercise launched by the industry regulator, the Tea Board of India, to bring within the net all segments of tea producers - organized and unorganized - many of whom were not reporting their crop statistics. Their share is approximately 29 per cent of the total production. Productivity varies in plantations from region to region and even within one plantation. The same plantation provides different grades of made tea. The management is also influential in achieving high productivity. The share percentage of India in World Tea production shows a decreasing trend year after year.

**Hypothesis**

There is no correlation between world tea production and tea production in India.

Karl Pearson’s Coefficient of Correlation is applied to find out whether there is any relationship between world tea production and tea production in India.

\[
r = \frac{N\Sigma dx dy - (\Sigma dx)(\Sigma dy)}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2 \times N\Sigma dy^2 - (\Sigma dy)^2}}
\]

**Where**

\(\Sigma dx dy\) = Sum of the product of the deviations of x and y series from their assumed mean.

\(\Sigma dx^2\) = Sum of the squares of the deviation of x series from all assumed mean.

\(\Sigma dy^2\) = Sum of the squares of the deviation of y series from all assumed mean.
$\Sigma dx = \text{Sum of the deviations of } x \text{ series from an assumed mean.}$

$\Sigma dy = \text{Sum of the deviations of } y \text{ series from an assumed mean.}$

**Table 1.6**  
Karl Pearson’s Coefficient of Correlation – World production of tea and production of tea in India

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<td>0</td>
<td>380</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>98</td>
<td>-1</td>
<td>1</td>
<td>388</td>
<td>8</td>
<td>64</td>
<td>8</td>
</tr>
<tr>
<td>98</td>
<td>-1</td>
<td>1</td>
<td>396</td>
<td>16</td>
<td>256</td>
<td>16</td>
</tr>
<tr>
<td>97</td>
<td>-2</td>
<td>4</td>
<td>419</td>
<td>39</td>
<td>1521</td>
<td>78</td>
</tr>
<tr>
<td>112</td>
<td>13</td>
<td>169</td>
<td>445</td>
<td>65</td>
<td>4225</td>
<td>845</td>
</tr>
<tr>
<td>N=10· &amp; -32 &amp; 638 &amp; N=10· &amp; -127 &amp; 21071 &amp; 34970</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Sigma dx$ &amp; $\Sigma dx^2$ &amp; $\Sigma dy$ &amp; $\Sigma dy^2$ &amp; $\Sigma dxdy$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$$r = \frac{3497 \times 10 - (-32) \times (-127)}{\sqrt{638 \times 10 - (-32)^2} \times \sqrt{21071 \times 10 - (-127)^2}}$$

$$= \frac{34970 - 4064}{\sqrt{(6380 - 1024) \times (210710 - 16129)}}$$

$$= \frac{30906}{\sqrt{5356 \times 19458}} = \frac{30906}{73.2 \times 441.1}$$

$$= \frac{30906}{322580.5} = 0.96$$
Inference

There is positive correlation between world tea production and tea production in India. Hence the hypothesis is rejected.

Tea growing areas in South India:

- Wayanad (Kerala)
- The Nilgiris (Tamil Nadu)
- The Anamallais (Coimbatore District, Tamilnadu)
- Nelliampathy (Palghat, Kerala)
- High Range (Iddukki District, Kerala)
- Vandiperiyr and Peermade (Iddukki District, Kerala)
- High Wavys (Madurai District, TamilNadu)
- Thiruvananthapuramum (Kerala)
- Singampatty (Tirunelveli, Tamil Nadu)
- Coorg (Karnataka)
- Hassan (Karnataka)
- Chikmagalur (Karnataka)

South Indian tea is grown under an area of approximately 115,000 hectares. Tamil Nadu is the major tea growing State in South India with 76,000 hectares under tea cultivation. Kerala has 37,000 hectares while Karnataka is a much smaller tea growing State with only just 2,000 hectares. Tea industry in South India has made significant paces on productivity front.

South Indian tea is facing competition from East African countries like Kenya, which have started exporting to other destinations, as their shipments to Egypt have come down due to the turmoil,
### Table 1.7
Production of tea in South India (in million kilograms)

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Year</th>
<th>Tamilnadu</th>
<th>Increase / Decrease</th>
<th>Kerala</th>
<th>Increase / Decrease</th>
<th>Karnataka</th>
<th>Increase / Decrease</th>
<th>South India</th>
<th>Share percent of Indian production</th>
<th>Increase / Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2002</td>
<td>143.1</td>
<td>-</td>
<td>57.8</td>
<td>-</td>
<td>5.8</td>
<td>-</td>
<td>206.7</td>
<td>24.7 (838.5)</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>2003</td>
<td>166.6</td>
<td>+23.5</td>
<td>58.0</td>
<td>+0.2</td>
<td>5.2</td>
<td>-0.6</td>
<td>229.8</td>
<td>26.2 (878.1)</td>
<td>+1.5</td>
</tr>
<tr>
<td>3.</td>
<td>2004</td>
<td>163.0</td>
<td>-3.6</td>
<td>62.2</td>
<td>+4.2</td>
<td>5.6</td>
<td>+0.4</td>
<td>230.8</td>
<td>25.8 (893.0)</td>
<td>-0.4</td>
</tr>
<tr>
<td>4.</td>
<td>2005</td>
<td>158.8</td>
<td>-4.2</td>
<td>63.4</td>
<td>+1.2</td>
<td>5.4</td>
<td>-0.2</td>
<td>227.6</td>
<td>24.1 (946.0)</td>
<td>-1.7</td>
</tr>
<tr>
<td>5.</td>
<td>2006</td>
<td>163.7</td>
<td>+4.9</td>
<td>59.5</td>
<td>-3.9</td>
<td>5.4</td>
<td>0</td>
<td>228.6</td>
<td>23.3 (981.8)</td>
<td>-0.8</td>
</tr>
<tr>
<td>6.</td>
<td>2007</td>
<td>160.5</td>
<td>-3.2</td>
<td>56.0</td>
<td>-3.5</td>
<td>5.2</td>
<td>-0.2</td>
<td>221.7</td>
<td>22.5 (986.4)</td>
<td>-0.8</td>
</tr>
<tr>
<td>7.</td>
<td>2008</td>
<td>170.5</td>
<td>+10.0</td>
<td>70.3</td>
<td>+14.3</td>
<td>6.1</td>
<td>+0.9</td>
<td>246.9</td>
<td>25.2 (980.8)</td>
<td>+2.7</td>
</tr>
<tr>
<td>8.</td>
<td>2009</td>
<td>169.4</td>
<td>-1.1</td>
<td>68.9</td>
<td>-1.4</td>
<td>5.8</td>
<td>-0.3</td>
<td>244.1</td>
<td>24.9 (979.0)</td>
<td>-0.3</td>
</tr>
<tr>
<td>9.</td>
<td>2010</td>
<td>170.7</td>
<td>+1.3</td>
<td>66.8</td>
<td>-2.1</td>
<td>5.9</td>
<td>+0.1</td>
<td>243.4</td>
<td>25.2 (966.4)</td>
<td>+0.3</td>
</tr>
<tr>
<td>10.</td>
<td>2011</td>
<td>167.1</td>
<td>-3.6</td>
<td>68.0</td>
<td>+1.2</td>
<td>5.0</td>
<td>-0.9</td>
<td>240.1</td>
<td>21.5 (1115.7)</td>
<td>-3.7</td>
</tr>
</tbody>
</table>

Source: The United Planters’ Association South India.

Note: (+) indicates increase and (-) indicates decrease in amount
In 2011, Tamil Nadu recorded a total production of 167.1 million kilograms, Kerala 68 million kilograms and Karnataka 5 million kilograms. Though the total production of tea in India has remarkably increased in 2011, the share percent of South India has decreased from 25.2 percent in 2010 to 21.5 percent in 2011. Especially the production of tea in Tamilnadu has decreased by 3.6 million kilograms and Karnataka has also decreased by 0.9 million kilograms when compared to the previous year 2010. But the production of tea in Kerala has increased by 1.2 million kilograms (66.8 million kilograms in 2010 and 68 kilograms in 2011).
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Year</th>
<th>Assam</th>
<th>Increase / Decrease</th>
<th>West Bengal</th>
<th>Increase / Decrease</th>
<th>Others</th>
<th>Increase / Decrease</th>
<th>North India</th>
<th>Share percent of Indian production</th>
<th>Increase / Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2002</td>
<td>433.6</td>
<td>-</td>
<td>189.1</td>
<td>-</td>
<td>9.1</td>
<td>-</td>
<td>631.8</td>
<td>75.3 (838.5)</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2003</td>
<td>434.8</td>
<td>+ 1.2</td>
<td>200.6</td>
<td>+11.5</td>
<td>12.9</td>
<td>+3.8</td>
<td>648.3</td>
<td>73.8 (878.1)</td>
<td>-1.5</td>
</tr>
<tr>
<td>3</td>
<td>2004</td>
<td>435.6</td>
<td>+ 0.8</td>
<td>214.5</td>
<td>+13.9</td>
<td>12.1</td>
<td>-0.8</td>
<td>662.2</td>
<td>74.2 (893.0)</td>
<td>+0.4</td>
</tr>
<tr>
<td>4</td>
<td>2005</td>
<td>487.5</td>
<td>+ 51.9</td>
<td>214.6</td>
<td>+0.1</td>
<td>16.3</td>
<td>+4.2</td>
<td>718.4</td>
<td>75.9 (946.0)</td>
<td>+1.7</td>
</tr>
<tr>
<td>5</td>
<td>2006</td>
<td>502.0</td>
<td>+ 14.5</td>
<td>237.1</td>
<td>+22.5</td>
<td>14.1</td>
<td>-2.2</td>
<td>753.2</td>
<td>76.7 (981.8)</td>
<td>+0.8</td>
</tr>
<tr>
<td>6</td>
<td>2007</td>
<td>511.9</td>
<td>+ 9.9</td>
<td>236.3</td>
<td>-0.8</td>
<td>16.5</td>
<td>+2.4</td>
<td>764.7</td>
<td>77.5 (986.4)</td>
<td>+0.8</td>
</tr>
<tr>
<td>7</td>
<td>2008</td>
<td>487.5</td>
<td>- 24.4</td>
<td>233.1</td>
<td>-3.2</td>
<td>13.2</td>
<td>-3.3</td>
<td>733.9</td>
<td>74.8 (980.8)</td>
<td>-2.7</td>
</tr>
<tr>
<td>8</td>
<td>2009</td>
<td>500.0</td>
<td>+ 12.5</td>
<td>221.6</td>
<td>-11.5</td>
<td>13.3</td>
<td>+0.1</td>
<td>734.9</td>
<td>75.1 (979.0)</td>
<td>+0.3</td>
</tr>
<tr>
<td>9</td>
<td>2010</td>
<td>480.3</td>
<td>- 19.7</td>
<td>229.8</td>
<td>+8.2</td>
<td>12.9</td>
<td>-0.4</td>
<td>723.0</td>
<td>74.8 (966.4)</td>
<td>-0.3</td>
</tr>
<tr>
<td>10</td>
<td>2011</td>
<td>589.1</td>
<td>+108.8</td>
<td>271.6</td>
<td>+41.8</td>
<td>14.9</td>
<td>+2.0</td>
<td>875.6</td>
<td>78.5 (1115.7)</td>
<td>+3.7</td>
</tr>
</tbody>
</table>

Source: Tea Board of India
Figures given in parantheses denote production of tea in million kilograms
Note: (+) indicates increase and (-) indicates decrease in amount
The production of tea in Assam stood at 589.1 million kilograms in 2011 (22.65 percent increase in 2011 as against 2010) as against 480.3 million kilograms in 2010. Besides, the production of tea in West Bengal stood at 271.6 million kilograms in 2011 (18.19 percent increase in 2011 as against 2010) as against 229.8 million kilograms in 2010. In brief, the production of North India registered a growth of 21.11 percent in 2011 (875.6 million kilograms in 2011 as against 723 million kilograms in 2010) and the share percent of North India to total production of tea in India also increased from 74.8 percent in 2010 to 78.5 percent in 2011.

1.10 EXPORT OF TEA FROM INDIA

Indian tea export has been an important foreign exchange earner for the Country. Unlike most other tea producing and exporting countries, India has dual manufacturing base. India produces both CTC and Orthodox teas in addition to Green tea. The weightage lies with the former due to domestic consumers’ preference. Orthodox tea production is balanced basically with the export demand. Production of green tea in India is small.

India has lost its leading position in tea exports over the last 20 years due to failure in facing the competition in International market because of which exports of tea has been reduced. The competitors to India in tea export are Sri Lanka, Kenya, China, Indonesia and Vietnam. While India is facing competition from Sri Lanka and Indonesia with regard to export of orthodox teas and from China with regard to green tea export, it is facing competition from Kenya and from other African countries in exporting CTC teas. The export of tea from India in terms of quantity and value are presented in the following Table:
Table: 1.9
Export of Tea from India

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Year</th>
<th>North India</th>
<th>South India</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Qty</td>
<td>Value</td>
<td>U.P</td>
</tr>
<tr>
<td>1.</td>
<td>2002</td>
<td>94.38</td>
<td>1055.8</td>
<td>111.87</td>
</tr>
<tr>
<td>2.</td>
<td>2003</td>
<td>92.20</td>
<td>1064.92</td>
<td>115.50</td>
</tr>
<tr>
<td>3.</td>
<td>2004</td>
<td>100.80</td>
<td>1203.85</td>
<td>119.43</td>
</tr>
<tr>
<td>4.</td>
<td>2005</td>
<td>98.70</td>
<td>1079.12</td>
<td>116.41</td>
</tr>
<tr>
<td>5.</td>
<td>2006</td>
<td>98.81</td>
<td>1191.70</td>
<td>120.60</td>
</tr>
<tr>
<td>6.</td>
<td>2007</td>
<td>102.72</td>
<td>1215.84</td>
<td>118.37</td>
</tr>
<tr>
<td>7.</td>
<td>2008</td>
<td>116.22</td>
<td>1592.41</td>
<td>137.02</td>
</tr>
<tr>
<td>8.</td>
<td>2009</td>
<td>110.53</td>
<td>1788.00</td>
<td>161.77</td>
</tr>
<tr>
<td>9.</td>
<td>2010</td>
<td>119.11</td>
<td>2055.01</td>
<td>172.53</td>
</tr>
<tr>
<td>10.</td>
<td>2011</td>
<td>107.64</td>
<td>2009.44</td>
<td>186.68</td>
</tr>
</tbody>
</table>

Source: Tea Board of India

Quantity: in million kilograms, Value: in crores, Unit price: Rupees per kilogram,

The export of tea from North India has decreased in 2011 by 9.63 percent when compared to 2010. The export of tea from South India has also shown a decreasing trend in 2011 (17.18 percent decrease) as against 2010. On the other hand, the total export of tea from India has also gone down by 13.13 percent in 2011 as against 2010.
Russia, the UAE, the UK, Iran, Kazakhstan, the US, Egypt, Afghanistan, Germany, Pakistan, Australia, Sri Lanka, Poland and Iraq are some of the major global markets for exports of Indian tea. The West Asian countries are the largest market for Indian tea exports and it accounts for nearly 25 per cent of exports.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Year</th>
<th>Export (Million Kg)</th>
<th>percent Increase / Decrease</th>
<th>Unit Price (Rs/kg)</th>
<th>Value (in crores)</th>
<th>% Share of Export in Production</th>
<th>World Total Export in Million Kg.</th>
<th>% Share of India in Total World Export</th>
<th>Increase / Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2002</td>
<td>201.00</td>
<td>-</td>
<td>87.23</td>
<td>1753.40</td>
<td>(838.5) 23.97</td>
<td>1432.00</td>
<td>14.04</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>2003</td>
<td>173.68</td>
<td>- 13.59</td>
<td>91.56</td>
<td>1590.21</td>
<td>(878.1) 19.78</td>
<td>1398.30</td>
<td>12.46</td>
<td>-1.58</td>
</tr>
<tr>
<td>3.</td>
<td>2004</td>
<td>197.61</td>
<td>+ 13.61</td>
<td>93.17</td>
<td>1841.13</td>
<td>(893.0) 22.14</td>
<td>1562.80</td>
<td>12.19</td>
<td>-0.27</td>
</tr>
<tr>
<td>4.</td>
<td>2005</td>
<td>187.60</td>
<td>- 5.07</td>
<td>90.49</td>
<td>1697.67</td>
<td>(946.0) 21.04</td>
<td>1570.10</td>
<td>12.70</td>
<td>+0.51</td>
</tr>
<tr>
<td>5.</td>
<td>2006</td>
<td>218.73</td>
<td>+ 16.59</td>
<td>91.73</td>
<td>2006.53</td>
<td>(981.8) 22.28</td>
<td>1581.63</td>
<td>13.77</td>
<td>+1.07</td>
</tr>
<tr>
<td>6.</td>
<td>2007</td>
<td>178.75</td>
<td>- 18.28</td>
<td>101.29</td>
<td>1810.11</td>
<td>(986.4) 18.12</td>
<td>1582.26</td>
<td>11.26</td>
<td>-2.51</td>
</tr>
<tr>
<td>7.</td>
<td>2008</td>
<td>203.12</td>
<td>+ 13.63</td>
<td>117.81</td>
<td>2392.91</td>
<td>(980.8) 20.71</td>
<td>1656.11</td>
<td>12.34</td>
<td>+1.08</td>
</tr>
<tr>
<td>8.</td>
<td>2009</td>
<td>197.90</td>
<td>-2.57</td>
<td>140.77</td>
<td>2785.85</td>
<td>(979.0) 20.21</td>
<td>1582.95</td>
<td>12.50</td>
<td>+0.16</td>
</tr>
<tr>
<td>9.</td>
<td>2010</td>
<td>222.02</td>
<td>+ 12.19</td>
<td>137.75</td>
<td>3058.31</td>
<td>(966.4) 22.97</td>
<td>1738.00</td>
<td>12.77</td>
<td>+0.27</td>
</tr>
<tr>
<td>10.</td>
<td>2011</td>
<td>192.87</td>
<td>-13.13</td>
<td>147.36</td>
<td>2842.07</td>
<td>(988.3) 19.50</td>
<td>1750.14</td>
<td>11.02</td>
<td>-1.75</td>
</tr>
</tbody>
</table>

Source: Tea Board of India
- Figures given in Parenthesis denote production of tea in million kilograms
- Note (+) indicates increase and (-) indicates decrease
The world export of tea has increased from 1738 million kilograms in 2010 to 1750.14 million kilograms in 2011, registering a growth of 0.70 percent. But the share percent of Indian tea export on world tea export stood at 11.02 percent in 2011 as against 12.77 percent in 2010, registering a decline of 1.75 percent. Furthermore, the share percent of Indian tea exports on Indian tea production is 19.5 percent in 2011 as against 22.97 percent in 2010.

1.11 IMPORT OF TEA INTO INDIA

The continuous fall in prices of tea, coupled with high cost of production has adversely affected the economy of the tea plantations resulting in some tea gardens being abandoned or under lock out in various States. The teas being imported are not necessarily inferior teas and the practice of blending with Indian teas often serves the purpose of providing teas as per customers’ choice and making them price-competitive in international markets.
Table: 1.11
Import of Tea into India:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Year</th>
<th>Quantity (Million Kg)</th>
<th>Percentage Increase / Decrease</th>
<th>Unit Price (Rs/kg)</th>
<th>Value (in crores)</th>
<th>World imports</th>
<th>Share percent of India on world import</th>
<th>Increase / Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2002</td>
<td>22.01</td>
<td>-</td>
<td>46.30</td>
<td>114.83</td>
<td>1373.2</td>
<td>1.60</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>2003</td>
<td>9.86</td>
<td>-55.2</td>
<td>58.33</td>
<td>57.51</td>
<td>1610.4</td>
<td>0.61</td>
<td>-0.99</td>
</tr>
<tr>
<td>3</td>
<td>2004</td>
<td>30.80</td>
<td>+212.37</td>
<td>45.88</td>
<td>141.32</td>
<td>1557.4</td>
<td>1.98</td>
<td>+1.37</td>
</tr>
<tr>
<td>4</td>
<td>2005</td>
<td>16.47</td>
<td>-46.50</td>
<td>58.65</td>
<td>98.51</td>
<td>1598.3</td>
<td>1.03</td>
<td>-0.95</td>
</tr>
<tr>
<td>5</td>
<td>2006</td>
<td>23.81</td>
<td>+44.60</td>
<td>65.43</td>
<td>119.41</td>
<td>1570.9</td>
<td>1.52</td>
<td>+0.49</td>
</tr>
<tr>
<td>6</td>
<td>2007</td>
<td>15.98</td>
<td>-32.9</td>
<td>65.43</td>
<td>104.60</td>
<td>1462</td>
<td>1.09</td>
<td>-0.43</td>
</tr>
<tr>
<td>7</td>
<td>2008</td>
<td>20.27</td>
<td>+26.9</td>
<td>79.90</td>
<td>161.97</td>
<td>1506.1</td>
<td>1.35</td>
<td>+0.26</td>
</tr>
<tr>
<td>8</td>
<td>2009</td>
<td>25.46</td>
<td>+25.6</td>
<td>84.23</td>
<td>216.03</td>
<td>1461.1</td>
<td>1.74</td>
<td>+0.39</td>
</tr>
<tr>
<td>9</td>
<td>2010</td>
<td>20.04</td>
<td>-21.3</td>
<td>92.26</td>
<td>214.44</td>
<td>1613.6</td>
<td>1.24</td>
<td>-0.50</td>
</tr>
<tr>
<td>10</td>
<td>2011</td>
<td>18.60</td>
<td>-7.2</td>
<td>92.84</td>
<td>172.69</td>
<td>1609.7</td>
<td>1.16</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

Source: The United Planters’ Association of Southern India
Note: (+) indicates increase and (-) indicates decrease in amount

During 2011, the quantum of tea imported into India declined to 18.6 million kilograms as compared to 20.04 million kilograms in 2010, a decline of 7.2 percent. The percentage share of Indian tea imports to world tea imports has also declined in 2011 by 0.8 percent (1.16 percent in 2011 as against 1.24 percent in 2010).

1.12 CONSUMPTION OF TEA IN INDIA

The consumption of tea in India was first clearly documented in the Ramayana (750-500 BC). For the next thousand years, documentation of tea in India was lost in history.
Records re-emerged during the first century AD, with stories of the Buddhist monks Bodhidharma and Gan Lu, and their involvement with tea. Research shows that tea is indigenous to eastern and northern India and was cultivated and consumed there for thousands of years.

India is also the world's largest tea-drinking nation. However, the per capita consumption of tea in India remains a modest 750 grams per person every year due to the large population base and high poverty levels. India is the largest consumer of the beverage in the world, consuming nearly 25 percent of the global tea production, according to a December 2011 report by trade association ASSOCHAM. The Indian tea industry is likely to reach a turnover of 33,000 crores by 2015, up from 19,500 crores at present, clocking a CAGR of 15 percent.” Tea is cheap, affordable, and addictive in nature. Nearly ninety percent of Indian households are regular tea-drinkers,” says ASSOCHAM Secretary General DS Rawat. “Awareness about health benefits associated with moderate intake of tea is a significant factor behind an upsurge in demand, as more and more people become aware of the healing properties of tea. It not only helps combat heart-related ailments but also lowers cholesterol, protects the skin, keeps cancer at bay, strengthens bones and teeth, and contains no calories, fat or salt. India’s per capita tea consumption stands at 711 grams per head during 2011. However, this is considerably lower than other tea drinking nations such as Ireland (3 kilograms), more than 2 kilograms in United Kingdom, Turkey, and Iraq, and more than 1 kilogram in Sri Lanka and Pakistan.

Penetration of tea in the non-alcoholic cold beverage segment is another driving force for this industry owing to the rising affinity towards ice tea which currently accounts for
over 5 percent of the entire non-alcoholic beverage market in India. The branded segment has a share of nearly 55 percent of the total tea market in India and is growing at about 20 percent every year, almost double the rate of the non-branded segment. Interestingly, Assam produces over half of India’s tea and accounts for over 12 percent of the annual global tea yield, according to ASSOCHAM. Reading the tea leaves, one may be forgiven for thinking that India would be a land where tea lounges exist in every corner, with their owners laughing all the way to the bank. India has always been a tea-drinking nation, but it is surprising that no big tea bar chains exist in the country, compared to the coffee cafes. However, in a welcome sign for those addicted to tea, some high-quality tea bars have begun to sprout in various Cities where they can enjoy a cup of tea in an air-conditioned cafe-like set up.

Tea is consumed both at home and outside. Outside the home, tea is most commonly and easily found at the ubiquitous tea stalls that dot just about every street in India. The tea stall has become a part of the urban landscape and a cultural institution, even celebrated as in the recent art exhibition titled “Chai Wallah and other stories” by the artist Vijay Gille. “Chai Wallah” is the Hindi title accorded to the man who runs the tea stall. “Chai-Pani” literally meaning, tea and water, on the other hand have become the preferred phrase to refer to the petty corruption that is rampant in India.

According to the historian Lizzi Collingham, the taste for tea was developed in India through a dedicated push on the part of the producers of tea once tea production in India gained momentum. Initially, free samples of tea were offered from horse drawn carts belonging to various companies. As early as 1907, Brooke Bond, an English tea company
started experimenting with a fleet of horse drawn vans for distributing teas. The British tradition of taking tea with a little milk and sugar was introduced along with the samples.

Unlike the British cup of tea, tea in India is not served in a set where the leaves are steeped separately. Typically, tea in India is consumed with both milk and sugar but the tea leaves are not prepared separately by being steeped. Instead, the tea leaves are boiled along with additions and then boiled again after the addition of milk and sugar. Sometimes the tea leaves themselves are used as flavouring. In many parts of the country, the most special tea is one where the tea leaves are boiled solely in milk.

There are many other popular variations depending on regional and cultural affiliations. By and large, tea drinkers in India drink milk tea. There are many other popular variations depending on regional and cultural affiliations. The now well known Masala Chai, Kadak Chai (typically a feature of the mountain community of North India, this is a very strongly brewed tea, almost to the point of bitterness) and Malai Mar Ke Chai (where a generous dollop of full fat cream is spooned into the cup of tea) are some of the more popular variations. Thus a lot of room is available for the growth in consumption of tea in the domestic market.
## Table No: 1.12
Consumption of tea in India

<table>
<thead>
<tr>
<th>Sl. No:</th>
<th>Year</th>
<th>Consumption of India (M Kgs)</th>
<th>Increase / Decrease</th>
<th>Consumption (Grains Per Head)</th>
<th>Share percent of consumption Production</th>
<th>Increase / Decrease</th>
<th>World consumption (M Kgs)</th>
<th>Share percent of India on world Consumption</th>
<th>Increase / Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>2002</td>
<td>693.0</td>
<td>100.00</td>
<td>663 82.6 (838.5)</td>
<td>-</td>
<td>3092.6</td>
<td>22.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>2003</td>
<td>714.0</td>
<td>103.03</td>
<td>672 81.3 (878.1)</td>
<td>-1.3</td>
<td>3199.1</td>
<td>22.3</td>
<td>-0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>3.</td>
<td>2004</td>
<td>735.0</td>
<td>102.94</td>
<td>681 82.3 (893.0)</td>
<td>+1.0</td>
<td>3227.2</td>
<td>22.8</td>
<td>+0.5</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>2005</td>
<td>757.0</td>
<td>102.99</td>
<td>691 80.0 (946.0)</td>
<td>-2.3</td>
<td>3361.6</td>
<td>22.5</td>
<td>-0.3</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>2006</td>
<td>771.0</td>
<td>101.85</td>
<td>693 78.5 (981.8)</td>
<td>-3.8</td>
<td>3644.2</td>
<td>21.2</td>
<td>-1.3</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>2007</td>
<td>786.0</td>
<td>101.95</td>
<td>696 79.7 (986.4)</td>
<td>+1.2</td>
<td>3667.9</td>
<td>21.4</td>
<td>+0.2</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>2008</td>
<td>802.0</td>
<td>102.04</td>
<td>701 81.8 (980.8)</td>
<td>+2.1</td>
<td>3779.3</td>
<td>21.2</td>
<td>-0.2</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>2009</td>
<td>819.0</td>
<td>102.12</td>
<td>706 83.7 (979.0)</td>
<td>+1.9</td>
<td>3826.9</td>
<td>21.4</td>
<td>+0.2</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>2010</td>
<td>837.0</td>
<td>102.20</td>
<td>711 86.6 (966.4)</td>
<td>+2.9</td>
<td>4042.8</td>
<td>20.7</td>
<td>-0.7</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>2011</td>
<td>856.0</td>
<td>102.27</td>
<td>718 86.6 (988.3)</td>
<td>0</td>
<td>4275.2</td>
<td>20.0</td>
<td>-0.7</td>
<td></td>
</tr>
</tbody>
</table>

Source: Primary data:
Figures shown in parentheses denote production in million kilograms
Note:(+) indicates increase and (-) indicates decrease in amount
According to Tea Board data, domestic consumption registered a record 856 million kilograms in 2011 as against 837 million kilograms in 2010. This increase of 19 mkg marked a growth of 2.27 per cent. In 2010, the consumption had risen by 18 million kilograms over the previous year to post a growth of 2.20 per cent. The per capita consumption rose to 718 grams in 2011 from 711 grams in 2010. The share percent of consumption to production did not show any increase or decrease in 2011. It remained same as of the previous year 2010. But the share percent of domestic consumption of tea on world consumption declined by 0.7 percent in 2011 when compared to 2010.

A new report from the Food and Agriculture Organization of the United Nations (FAO) urges tea-producing countries to increase income from the crop by marketing the drink more heavily at home and publicizing the health benefits of the beverage abroad.

1.13 NEED FOR THE STUDY

Businesses stay in business by attracting and retaining customers. They do this by engaging in exchanges of resources including information, money, goods, services, status, and emotions with consumers, exchanges that both businesses and consumers perceive to be beneficial. When companies ask, who are our customers? How do we reach them? What should we sell to them? What will motivate them to buy? What makes them satisfied? They are asking questions that require sophisticated understanding of consumer behaviour.

Competition among global and local players for winning market share has always been severe. To exist in beverage manufacturing industry and gain market share, requires accurate and precise strategies in choosing brand, type of beverage products,
target market and anticipate which market segment to be entered. Many researches are
done to understand the consumer attitudes and behaviour. However, to survive within
the intense competition, a distinctive core and values are required to be made. As such,
the tea marketers may focus on marketing factors and consumer behavior factors which
form along consumer preferences in purchasing tea. The marketing factors include
marketing mix (product, price, place, and promotion) strategies, while the consumer
behaviour factors focus on group (cultural, sub-cultural, social class, and reference
group), product class and situational influence factors which affect the consumer
decision making. Derived from the result of the research of consumer purchasing
decision and brand preference in buying beverage products, it is initiated that the tea
marketers need to be responsive in dealing with consumer attitudes and characteristics as
part of consumer behaviour factors and shaping appropriate marketing factors since
several variables within each factor have significant influence on consumer purchasing
decision in buying tea. In this study the researcher has attempted to analyze the
behaviour of consumers in purchasing tea. The study has been conducted among
consumers of tea in Tirunelveli District.

1.14 DESCRIPTION OF TIRUNELVELI DISTRICT

Tirunelveli, the penultimate southern most district of Tamil Nadu, is described as a
microcosm of the State, owing to its mosaic and diverse geographical and physical
features such as lofty mountains and low plains, rivers and cascades, seacoast and thick
inland forest, sandy soils and fertile alluvium, a variety of flora, fauna, and protected
wild life. The District was formed in 1790 by the then ruler East India Company. This is
one of the oldest residential as well as historical parts of the world. The name
‘Tirunelveli’ has been composed from the three Tamil words is ‘Thiru-Nel-Veli’ meaning ‘Sacred Paddy Hedge’.

Tirunelveli is located at 8.73°N 77.7°E, and its average elevation is 47 metres (154 ft). It is located at the southernmost tip of the Deccan plateau. The total geographical area of the district is 6,823 square kilometers. The District is surrounded by the State of Kerala, Gulf of Mannar and the districts of Virudhunagar, Thoothukudi and Kanyakumari. The economy of Tirunelveli District is chiefly agrarian in nature and people are engaged in the cultivation of pulses, groundnut, gingili, coconut, chillies, indigo and cotton. It is rich in mineral resources of limestone, sulphides and limonite - garnet sands. The lofty legendary life – line of this District is the River Tamiraparani that flows across the District.

According to 2011 census, Tirunelveli District has a population of 3,072,880, roughly equal to the nation of Oman or the US State of Iowa. The district has a population density of 458 inhabitants per square kilometre (1,190 /sq mi). Its population growth rate over the decade 2001-2011 was 13.66 percent. Tirunelveli has a sex ratio of 1024 females for every 1000 males, and a literacy rate of 82.92 percent.
1.15 OBJECTIVES OF THE STUDY

1.15.1 To study the historical evolution of tea industry in global perspective and Indian perspective.

1.15.2 To study the theoretical aspects concepts of consumer behaviour

1.15.3 To study the socio-economic factors influencing the purchase of tea.

1.15.4 To study the brand preference and brand loyalty of consumers in purchasing tea

1.15.5 To study the brand awareness of consumers in purchasing tea.

1.15.6 To study the health related issues associated with consumption of tea.

1.15.7 To study the awareness of consumers regarding impact of drinking tea.

1.15.8 To study the behaviour of consumers on frequency of purchasing tea and the frequency of drinking tea.

1.15.9 To analyze the factors influencing consumers in purchasing tea.

1.15.10 To give solid suggestions based on the study.

1.16 HYPOTHESES

1.16.1 There is no relationship between world tea production and tea production in India.

1.16.2 There is no relationship between demographic factors of consumers and their brand awareness in purchasing tea.

1.16.3 There is no relationship between gender of consumers and awareness of consumers of manufacturers of tea.
1.16.4 There is no relationship between demographic factors of consumers and their awareness regarding impact of drinking tea.

1.17 OPERATIONAL DEFINITION OF CONCEPTS

1.17.1 Brand

Brand is the "name, term, design, symbol, or any other feature that identifies one seller's product distinct from those of other sellers".

1.17.2 Carton

Carton or cardboard is the name of certain types of containers typically made from tetra pack and paperboard. Many types of cartons are used in packaging.

1.17.3 Consumer

The consumer is the one who pays to consume the goods and services produced.

1.17.4 Sachet

A sachet is a small sealed envelope, usually made of plastic or paper, for containing sugar, salt, shampoo, etc

1.17.5 Tea Bag

A tea bag is a small, porous sealed bag containing tea leaves and used with water for brewing the beverage called tea, or herbs or spices for brewing tisanes. Tea bags are commonly made of filter paper, silk or food grade plastic. The bag contains the tea leaves while the tea is steeped, making it easier to dispose of the leaves, and performs the same function as a tea infuser. Some tea bags have an attached piece of string with a paper label at the top that assists in removing the bag while also displaying the brand and/or variety of tea.
1.17.6 Packaging

Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of design, evaluation, and production of packages.

1.18 METHODOLOGY OF THE STUDY

The information required for the study are collected by means of primary as well as secondary sources in order to accomplish the various objectives of the study.

Primary data

The primary data related to the consumption behaviour of tea are collected from 550 respondents belonging to 11 Taluks of Tirunelveli District. An adhoc questionnaire was prepared and a pilot study was made by the researcher with 50 consumers of tea. After undertaking pilot study, necessary additions and modifications were made in the questionnaire. Some of the irrelevant questions were omitted and the final draft was prepared keeping in view the objectives of the study. Information on the following aspects were collected from the respondents.

(i) General information from the individual respondents regarding their social, economical and demographic characteristics like age, gender, education status, occupation, monthly income and family size.

(ii) Information regarding the consumption pattern of tea.

(iii) Attributes influencing the preference of a particular brand of tea.
Direct personal interviews were also conducted with Shop keepers, Tea Stall Owners and Restaurant Owners to elicit essential information pertinent to the study. Observation method is also adopted wherever necessary.

**Secondary data**

Secondary data relevant to the study have been collected from different published documents of the Government like Economic Reports, Year Books, Reports of Tea Board of India, United Planters Association of Southern India (UPASI), different Tea Companies and other Research reports, books, journals, magazines, newspapers and websites. Besides the researcher has also referred several unpublished works like Ph.D. Dissertations, M.phil Dissertations and Working papers of various researchers.

**1.19 SAMPLE SIZE**

The samples for the study are selected by the researcher from the Taluks of Tirunelveli District. Utmost care has been taken by the researcher to select equal number of samples from each Taluk of Tirunelveli District. Stratified random sampling is adopted by the researcher in order to obtain samples. There are 11 Taluks in Tirunelveli District. Each Taluk is considered as a stratum and 50 samples are selected from each stratum as a representative of the population (50 x 11 = 550 samples).
Table 1.13
Selection of samples from Tirunelveli District

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the Taluk</th>
<th>Number of samples selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alangulam Taluk</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Ambasamuthiram Taluk</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Nanguneri Taluk</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>Palayamkottai Taluk</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Radhapuram Taluk</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Sankarankovil Taluk</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Shenkottai Taluk</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>Sivagiri Taluk</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>Thenkasi Taluk</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>Tirunelveli Taluk</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>Veerakeralamputhur Taluk</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>550</strong></td>
</tr>
</tbody>
</table>

1.20 TOOLS OF ANALYSIS

The collected data and information were tabulated, processed and analyzed critically in order to make the study more informative, fruitful and purposeful.

Percentage analysis was used to study the socio-economic characteristics of sample respondents like age, educational status, occupation, family income and family size. The consumption behaviour of consumers towards tea, place of purchase, frequency of purchase, frequency of consumption and quantity purchased were also analyzed using percentage analysis.

Statistical analysis was done to draw meaningful inferences.

- Karl Pearson’s Coefficient of correlation is applied by the researcher to find out the relationship between domestic tea production and world tea production.

- Chi square Test is applied by the researcher to find out the relationship between demographic factors of consumers and their brand awareness in purchasing tea.
Chi square Test is also applied to find out the relationship between Gender of consumers and awareness of consumers regarding manufacturers of tea. Furthermore, the relationship between demographic factors of consumers and their awareness regarding impact of drinking tea is also analyzed with the help of Chi square Test.

Garrett’s Ranking Technique is applied to analyze the factors influencing consumers in purchasing tea.

1.21 CHAPTER SCHEME

The first chapter presents the design of the study. It consists of the details regarding cultivation and harvesting of tea, processing and classification of tea, blending and additives of tea, components of tea, health effects of drinking tea, major tea growing regions in India, production of tea in India, export of tea in India, import of tea in India, consumption of tea in India, need for the study, description of Tirunelveli District, objectives of the study, hypothesis framed, operational definition of concepts, methodology of the study, samples selected, tools of analysis and the chapter scheme.

The second chapter presents the review of literature pertinent to consumer behaviour and studies alike.

The third chapter gives a detailed description of the consumer behaviour. It explains the need for studying consumer behaviour, factors influencing consumer behaviour, roles in consumer decision-making, buyer decision-making process, nature of consumer behaviour, consumer behaviour theories, consumer decision rules and levels of consumer decision-making.
The fourth chapter describes the history of tea in global perspective, constitution, organization and functions of Tea Board of India, key players in Indian tea market and SWOT analysis of Indian tea industry.

The fifth chapter presents the analysis of the behaviour of consumers in purchasing tea.

The sixth chapter presents the findings of the study and gives some solid suggestions relevant to the study.
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