

## INVESTIGATION INTO THE PHYSICAL PROPERTIES AND ORGANOLEPTIC CHARACTERISTICS OF TEA LEAVES

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### ABSTRACT

With the prove that tea is the second worldwide accepted beverage after water and valued for its stimulating, relaxing, medicinal and other factors, the study focused on investigating the physical characteristics and organoleptic properties of the beverage. There are three different types of tea from which almost all other categories with the exception of herbal teas were derived. Quasi-experimental research method was adopted in the study and the total population comprises of all the staff at Hassan Usman Katsina Polytechnic used as the study area. Purposive sampling method was used in sampling the 5 principal officer as well as the 7 college directors, while proportionate random sampling was used in sampling 21 H.O.Ds across the seven colleges in the institution, given a total of 33 respondents regarded as the sample size for the study. Structured 9 points hedonic scale questionnaire was used in retrieving data from the sampled respondents. It was identified that with an average mean of 8.9, 8.7, and 7.7 respectively, black tea has the highest preference regarding physical characteristics in term of small-leave, large-leaves, and bright-red colour. Green tea has the higher preference in term of lemon-yellow colour with mean average of 7.9 and oolong tea in term of pale-yellow colour with 7.7. Black tea also has the highest preferences in term of all the organoleptic variables tested (taste 8.6, texture 6.2, aroma, 8.8 and colour, 8.3) with overall acceptability of 8.0. it was concluded that tea consumers now understand the different physical characteristics as well as organoleptic properties of tea which helps them a lot in selection. It is recommended that marketers should always label each category of tea according to its class for easy identification and selection.

**Keyword:** Physical, Organoleptic, Properties, Characteristics, Tea

### 1. INTRODUCTION

Tea is one among the group of beverages that is accepted worldwide by different countries, groups of people regardless of their religion, tribe, ethnicity or economic group because of its abundance and affordability. It is obtained from an evergreen plant known as *Camellia Sinensis* which belongs to a family *theaceae* (Oluyole, Daniel and Yahaya, 2015). The beverage is consumed on its own after insertion of the leaves into boiled water or can be blended with other ingredients such as herbs, fruits or spices (Graham, 1992). The beverage is consumed in Europe and America and in Asia most especially in the countries where it is widely produced. Sowunmi, Aroyeun, Okoruwa and Biobaku (2009) opined that tea consumption among different categories of people in Nigeria is common at various occasions or even at leisure period. Based on its increasing demand by many people for different purposes, tea is proved to be one of the major products of the world beverages market as well as second widely consumed beverage after water. Teas are classified based the fermentation process they have undergone into three categories; the non-fermented category known as green tea, the semi-fermented category known as oolong teas and the full fermented type otherwise known as black tea (Mukhtar and Ahmad, 2000). The fermentation refers to the action of enzyme that helps to catalyse the reaction that led oxidation process to take place during the manufacturing process of tea.

Beverages most especially the non-including types in which tea inclusive are becoming integral part of many people's life style which are valued depending on the consumers' choice or reason of drinking it. Some people are consuming it just to quench thirst when the weather is a cold, some by prescription from a health personnel, some for energy, some for hunger where it accompany some other things like snacks, where some consume it just to cool down or warm up (Fiji Beverage Group, 2017). According to Artful Tea (2019) as tea differs in its category, it is chosen by many people based on lifestyle, age, stage or the occasion which calls for its consumption. They further buttresses that, some people consume tea for its boosting, stimulating, calming, relaxing as well as mental focus and cognitive functioning. Asia is by far the biggest producer supplying 80-90% of all tea, mainly from India, China, Sri Lanka and Indonesia. India is the largest individual tea-producing country, growing nearly 30% of the world's tea. Tea was introduced to East Africa at the beginning of the 20th century. It has become an important crop there, particularly in the highlands of Kenya (Pilot Guide, 2021).

It is believed that characteristics possess by tea leaves such as its physical appearance before it under goes any processing method, the aroma and flavour it gives off before and after it is steeped and its colour after infusion are the factors used

to determine the characteristics of a tea (Liang et al, 2003). In contrast to this finding Sharma (2005) stated that, because of the way colour is chemically affected in many reactions in which tea inclusive, it is very difficult to assess the tea quality based on its colour. Chemical compounds such as theaflavin and thearubigins are chemical compound which gave fermented teas their yellow-orange colour but are missing in green teas (it possess catechins which are group of natural polyphenols accounting for its colour and flavour) which makes them yellowish-green. Normal tea has to be differentiated from the other categories complemented with other ingredients when assessing its quality, as many teas are now incorporated with ingredients such as herbs and spices (Amy, 2020).

According to Oge (2017), Nigerian is considered one of the countries where tea is highly accepted and consumed at various times of the day and for different purposes and the Northern part of the country is the highest tea consuming part of the country. To prove that the Northerners are great lover of tea; it is a common sight to behold every corner of the streets filled with “mai chai” (tea master) who brew and sell tea per cup especially to meet the need of people who are working on the move and in shops and do not have the time to take a break to boil water and brew their own cup. However, it is pertinent to identify that majority of those people drinking tea in these points or even those who normally buy tea bags from shops and supermarkets are only drinking the beverages without prior knowledge of the categories. To worsen the situation, majority of the consumers only receives the product after it has been incorporated with other things such as milk, herbs or spices which make it very difficult for them to identify the type these drunk. Based on this, the present study is set to investigate the physical properties and organoleptic characteristics of tea leaves. The following objectives will serve as guide to the study:

- To identify the major approved categories of tea accepted by stakeholders worldwide.
- To determine the physical characteristics of each category before and after being steeped.
- To examine the organoleptic characteristics of each category before being incorporated with other ingredient.

### **Brief History of Tea**

History of tea is long and is traced across many countries for thousands of years as some sources such as Pilot Guide (2021) are of the view that tea originated in around 2737 BC in China. It was revealed that when one of a highly disliked Emperor of China Shen Nung was dethroned and taken for isolation to Sothern part of the country in some mountains around Sichuan and Yunnan. As a royal father who loved palatable food and drink and now has no means of getting all that than relying on what is available around him, he took the habit of isolating himself under a tree. On the process one day when he was boiling water, a gust of wind picked and dropped some leaves into his pot of boiling water. He found the taste and flavour of the blend in his pot highly fascinating and relaxing and found his stomach ache he was suffering with after ingesting a toxic herb cured, which makes him to stay in that particular place for seven years just wandering the area and recording many infusion from leaves, herbs and other spices and drink no other beverages than that blend. Emran (2021) postulated that, it has been scientifically discovered that chemical compound polyphenols found in tea leaves inhibit the growth of harmful bacteria in the gut of human beings which helps advantageous bacteria to flourish harbouring antimicrobial properties that can get rid of harmful substances.

However, tea beverage continues to be more and more accepted in China most especially with the contribution of the Emperor Tang (616-907) which makes traders that visits China from different parts of the world to admire the drink and started trading it back to their various countries. Within little time drinking tea spread in Europe, Asia and even America (Liang et al, 2003). It was discovered in history that people in China drunk tea for hundreds of years and regarded it highly beneficial as medicine and as a form of religious offering before it was discovered useful in Europe and other parts of the World. Tang’s Dynasty was considered as the period for the boom of tea trade and consumption as there were times when the beverage was scarce and very rare which makes it a drink for only the royalty until more categories were discovered during the dynasty which makes it easier for even the lower class to afford. The period is still considered as the period for spread of tea to other countries (Emran, 2021). It was reported that one of the Japanese priest studying in China took back tea home and share it across his family, friends and his fellow priests and they found it drink fascinating and adopted it whenever they are having any get together and found it to keep them awake throughout their meeting. Based on this, certain days were separated as Japanese Tea Ceremony days which make tea drinking a spiritual and serious experience in Japan. Because of his love with tea, the Japan Emperor ordered for tea seeds and ordered for their grown in the country for it to be available so that all their populace can afford it (Ambar, 2019).

The first book on tea, ‘Cha’a Ching’, was written in the 8th century by the Chinese author, Lu Yu. This definitive manual described the cultivation and preparation of tea. Before long tea became China’s national drink. In Japan tea was elevated to an art form with the creation of the Japanese Tea Ceremony. It is also associated with Zen Buddhism, due to its early use in meditation (Pilot Guide, 2021). Asia is by far the biggest producer supplying 80-90% of all tea, mainly from India, China, Sri Lanka and Indonesia. India is the largest individual tea-producing country, growing nearly 30% of the

world's tea. Tea was introduced to East Africa at the beginning of the 20th century. It has become an important crop there, particularly in the highlands of Kenya.

### Constituents of Tea Leaves

Tea which is obtained from plant *camellia sinensis* contains what is termed as caffeine as constituent responsible for the stimulating aspect of the drink. This nutrient contributes only a little property to the colour, aroma and flavour of the beverage (Kris, 2018). According to Nanri et al. (2019), drinks made from pure tea leaves contains this nutrient ranging from quarter to half as much as that present in coffee per cup. Coffee is believed to be the world's major constituent of caffeine and tea is identified to be the second. Beside caffeine tea also contains two substances related to caffeine: theobromine and theophylline (they belong to chemical compound called Xanthines). Finally, it provides a rather unique amino acid called L-theanine, which has some very interesting effects on the brain. According to Simone et al. (2015), there are several theories about how it works. The main one is that it is believed to block an inhibitory neurotransmitter called adenosine at certain synapses in the brain, leading to a net stimulant effect. According to Marla and Manuel (2014), the body naturally produces and supplies adenosine in the brain all hours of a day which causes the body to create a "sleep mood." Therefore the more adenosine the body is able to produce, the more the body feels to fall asleep. However, caffeine has the capability to reverse this effect in drastic way.

Tea is considered the best alternative for people who are sensitive to high amount of caffeine which is normally present in coffee as such tea is preferable to coffee for those who have the intention of studying for longer period due to the presence of L-theanine, a chemical compound with lot of effects on alpha waves in the brain (Artful Tea, 2019). The catechins found in tea which are antioxidants including epigallocatechin gallate (EGCG) is responsible for up to 42% of the dry weight of brewed green tea and the L-theanine amino acid account for up to 3%. The epigallocatechin gallate when consumed is found to be responsible for the calmness in consumers as well as improve their memory and attention (Valleybook, 2021). Beside caffeine, another important and recognized constituent of tea is the tannins (known as polyphenols) which are responsible for the bitter-test in tea but lacks colour which gives the beverage its astringency property. Polyphenol oxidase an enzyme when acted upon polyphenols makes tea to acquire a reddish colour and form the flavouring compounds of the drink (Emran, 2021).

### Different type of Tea Leaves and their Physical Properties

Tea as a drink is prepared through steeping of leaves obtained from a plant known as *camellia sinensis* in boiled water. The plant is of two different categories; the variety called *sinensis* small-leaved China plant and the *assamica* variety which is a large-leaved plant called Assam. Combination of these two plants as a hybrid is also grown and the leaves are fermented or left unfermented (Emran, 2021). Tea is also categorized based on the region where it originates. For example, African tea, China tea, Ceylon tea, Japanese tea, Indonesian tea etc. it is also categorized by some scholars based on the district where the tea leave is common and obtained. For example, Kahawa Wendani and Sucari in Kenya, Keemun from Chi-men in China's Anhwei Province, Darjeeling, Assam, and Nilgris from India, Enshu from Japan as well as Uva and Dimbula from Sri Lanka.

Teas are commonly classified by some scholars based on the size of the leaves after it has undergone all the processing methods. If traditional method is applied the resultant leaves are larger and smaller leafy grades. These leafy grades are further grouped into flowery pekoe (FP), orange pekoe (OP), pekoe (P), pekoe souchong (PS), and souchong (S). The broken grades are: broken orange pekoe (BOP), broken pekoe (BP), BOP fanning, fannings, and dust. The later is tenderer in texture while the former is tougher as it is normally obtained from mature leaves of the tea plant. Broken grades in the modern world dominated the tea market as compared to earlier when substantial quantity of leafy grades was produced (Nanri et al., 2019). One of the acceptable classifications of tea worldwide is by the manufacturing process which in the process gave up to three categories of tea: Black tea which is the fermented type of tea, Green tea which is the unfermented category and lastly the Oolong or Pouchong tea which is the semi-fermented category (Marla and Manuel, 2014).

### Organoleptic Properties of Tea

Acceptability of many foods and drinks depend largely on the colour, flavour, taste and texture of the final product as they are easily accessible by the consumer. In many occasions where a consumer experience off colour, off flavour and poor texture from a food product, the food is normally rejected.

Green tea is a native of China plant which is transported to and grown in some other countries like Japan, Indonesia and Malaysia. The tea leaves are flogged and infused which gave rise to green colour in the leaves. The liquid end product is found to be slightly bitter in taste as well as mild, pale green and sometimes lemon-yellow in colour (Graham, 1992). The black tea is the most common category among all classes of tea produced worldwide which is produced from Assam or the combo i.e. hybrid of small and large leave *sinensis*. The resultant liquid obtained from this category not bitter as





**Source: Field Survey, 2024.**

Three different teas were steeped/infused and presented to the selected panellists to test for their organoleptic properties in order to find the one with highest preference in the study area. The findings of this study indicated that among all the produced tea samples, black tea category was the one most accepted, preferred by the panellist and with highest mean score of (8.6) in term of taste. According to Kris (2018), taste of food is mainly composed of five basic sensations; that is sweetness, astringency, sourness, bitterness and umami. A delicious cup of tea infusion according to Lea et al. (Amy, 2020), is an ingenious balance of various taste sensations.

Texture of the product is one of the aspects which need to be considered for testing the organoleptic properties of the products. The finding therefore reveals that, among all the tea samples prepared, black tea category has the higher preference with mean score of (6.2). It was followed by green tea with (5.8) and oolong with (5.0) respectively.

Aroma is another variable used in testing the organoleptic properties of the products produced from the tea leaves. The finding to this regard revealed that black tea with mean scores of (8.8) has the higher preference. It was followed by green tea and oolong with mean scores of (8.2, and 8.0) respectively. Aroma is one of the critical aspects of tea quality which can determine acceptance or rejection of a tea before it is tasted. According to Emran (2021), early research on tea aroma can be traced back over 170 years but progress on a more scientific basis has been achieved by the application of modern analytical techniques since 1960's, when gas chromatography was widely used, especially when capillary column techniques are available.

Colour is another important variable when dealing with organoleptic properties of food. The result of this study indicated that among the produced tea products black tea category has the highest preference regarding colour with mean score of (8.2). It was followed by green and oolong teas with (8.0 and 7.8) respectively. Colour of oolong tea was least preferred with mean score (7.8) under the colour aspect. Beside aroma and taste, colour is one important attribute considered when evaluating tea and tea infusion. Also shade and infusion colours are the categories given more emphasis on tea colours. According to Owuor and Obanda (2001), green tea infusion contains no highly coloured products formed by the oxidation of polyphenolic compounds, and the desired colour is greenish or yellowish green without any trace of red or brown colour. The green color is the main shade of color in the infused leaf and the infusion of green tea. It is mainly determined by the chlorophyll content and the ratio of chlorophyll A which is dark green and chlorophyll B which is yellowish-green in colour. On the other hand, a greyish appearance may possibly be due to poor processing or even an indication of spoilage or adulteration. The infusion colour of oolong tea is generally reddish-brown in moderate to heavy fermented oolong and dark greenish colour in light fermented oolong. According to the literature, this study sampled the tea leaves for the identification of their physical characteristics and organoleptic properties. This finding suggests that among all the tea samples, the black tea is the most desirable, appealing, accepted and preferred by the test panelists in term of physical properties and organoleptic characteristics except in colour where green tea with an overall mean score of (7.9) was preferred over it.

### 3. CONCLUSION AND RECOMMENDATIONS

It was concluded based on the findings of this study that tea is consumed by different categories of people (young, adolescent and adult) at different times of a day or for different purposes. The findings revealed that tea consumers now understand different physical properties and organoleptic characteristics of tea which helps them in selection. Further studies can be carried out to identify the physical properties and organoleptic characteristics of tea when blended with herbs and spices as normally practiced in many homes and tea joints nowadays. Based on the findings of this study, the following recommendations are made to various stakeholders concerned with the subject:

- The tea marketers should always make sure they label each category of tea according to its group for easy identification.
- Government and other stakeholders should ensure that only quality grades of tea are imported into the country.
- People should try to acquire knowledge on how teas are made using different methods such as infusion, brewing and steepening.
- People should also acquire knowledge on the exact quantities of tea they are supposed to be consuming so as not to exceed the required caffeine in the body.

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