Estimating the Caffeine and Some Elements in Different Types of Tea Market (Green Tea) and Tea Grown in Libya and Comparing BetweenEach Other.

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Abstract

This study included the determination of caffeine and elements in the different varieties of tea samples (local tea, China green tea (NAPT), Kabbos, Wazzah, and Lipton Yellow Label) These elements are Ca, F, Na, and K where it was determinedby using the Flame photometer model BWB Technologies UK LTD. the resultshave shown that the highest elemental value for sodium and potassium was in local tea (123.4ppm, 317.4ppm) respectively, and the highest value for calcium was in China green tea(NAPT) (98.3ppm), while the amount of extracted caffeine was the highest value for it in Kabbos (2.6g) and followed in Wazzah (2.1g)

Keywords: Caffeine, Elements, Flame photometer, Imported tea, Local tea,

1. Introduction

Tea is the most widely consumed non-alcoholic beverage in the world. The origin of tea as a beverage is so old that it is lost in legend. Tea is derived from terminal leaves of the shoots from the plant Camellia sinensis L. (Kuntz)native to Southeast China. C. Sinensis var. Sinensis is indigenous to Southeast China, Darjeeling, and Japan. C.Sinensis var. Assamica is indigenous to Assam, Thailand, and Sri Lanka [1]. Catechin is the most abundant polyphenol in fresh tea leaves. Three main types of tea are black tea, oolong tea, and green tea. Also, Black tea is produced by complete fermentation of tea leaves resulting in the black or brown color of tea where catechins are oxidized by polyphenol oxidases. While, Green tea isproduced by inactivating polyphenol oxidase enzymes by steaming or roasting freshly plucked leaves to bypass the fermentation step resulting in the weaker flavored green color oftea. When any type of tea leaf is steeped in hot water it brews a “tart” (astringent) flavor i.e. dry and pucker feeling characteristic of tannins [2].In terms of chemical composition teas contain tannin substances, flavones, proteins, aminoacids, aroma-producing volatile substances, enzymes, vitamins, mineral compounds, andmicroelements as well as alkaloids [3, 8]. The importance of tea beverages in the daily diet is mainly connected with their valuable mineral ingredients, most of all such elements as Ca,Na, K, Mg, and Mn as well as physiological properties resulting for instance from the caffeine contained in them. In addition to micro and macro elements, beneficial for health, plants of Camellia Sinensis have the ability to accumulate aluminum, whose contents may reach the level of 1g/kg in dried leaves [5]. Although in general, the element does not pose threat to living organisms, in the acidic environment, it may be highly toxic, which in turn results in numerous health conditions, such as Alzheimer’s disease, Parkinson’s disease, hence its presence in products raises many controversies.

The high consumption of tea is attributed to richness in important substances having cool, a little bitter flavor, antioxidant properties, and health benefits [9]. The chemical components in tea include alkaloids (theobromine, caffeine, theophylline), polyphenols (catechins, flavonoids),

amino acids, polysaccharides, volatile acids, vitamins, lipids as well as inorganic[10,11] The regular consumption of tea can contribute to the daily dietary requirement of some of the important minerals [12].

A lot of health benefits of tea were reported by researchers which may include antitumor [9], anti-carcinogenic [13], and anti-arteriosclerotic agents [14]. To gain these health benefits tea is used in form of powders, soft extracts, and strong infusions [15]. Green tea catechins (GTC), are an important constituent of tea that has received much attention as a protective agent against cardiovascular disease and cancer [16]. Tea polyphenols and Tea polysaccharides including flavonoids play an important role in the bio-activities of tea [17,18].

The chemical composition of tea varies and largely depends on climatic conditions,horticultural practices, soil, growth altitude, plucking season, sorting, grading, processing, extraction, storage, and drying [19,20]. Variability in the composition is an important factor that dictates the taste, flavor, and health benefits of a specific type of tea [21]. There is adirect association between tea quality and the content of tea amino acids, caffeine, and polyphenols in tea leaf [22,23].

Tea leaves contain 10–30% of the dry weight of polyphenols, including catechins, flavonols, flavanones, phenolic acids, glycosides, and the aglycones of plant pigments [24]. Tea extracts are powerful antioxidants and the major tea catechin are (-)-epicatechin, (-)- epigallocatechin, (-)-epigallocatechin gallate, and (-)-epicatechin gallate [25]. The main tea phenolic acid is gallic acid, while it also contains a certain amount of caffeine. Among the composition of tea, some well-known elements are catechins, phenolic acid, and caffeine. However, in commercial tea beverages, the composition differs with species, season, horticultural conditions, and particularly with the degree of fermentation during the manufacturing process. There are three types of tea: green, oolong, and black, which are produced from a single plant species, and the varieties are distinguished via the processing technique. During the processing phase, Green tea will not be fermented, Oolong tea will be partially fermented, and black tea will be completely fermented [26].

2. Experimental

I. Materials and methods

In the order to obtain the objective of this paper. Na,K,Ca and F were determined By Flame photometer model BWB Technologies UK LTD.

II. Collection of sample:

The sample of local green tea grows in the farm of the southern Libyan region, the local sample was taken from Zewaila Square No. 1 projects, collected leaves in November 2019, and then washed with distilled water and dried for a week at normal room temperature.

III. Preparation of Tea Extract

1g of tea sample was added to 25 ml of distilled water and heated in a magnetic stirrer at 70°C for 5 minutes. The decoction was cooled and filtered through Whatman No.1 filter paper. The filtrate was then centrifuged at 10000 rpm for 15 minutes. The supernatant was collected in a sterile clean screw-capped tube and stored at 4°C for future analysis.

IV. Determination of The Elements

Tea extract taken for analysis with an atomic absorption device to determine the elements Ca, F, Na and K.

V. Extraction Caffeine

30 g of tea leaves and 300 ml of distilled water were added and 30 g of CaCO3 were added and heated to boiling for 25 minutes with stirring by a glass rod. The mixture was filtered through the Buchner funnel and the filtrate was transferred into a separating funnel of 250 ml size. 80 ml of chloroform were added to the separating funnel and swirled gently for 5 minutes. Then, the mixture was left to settle in order for the chloroform layer to be exhibited. The separating funnel stopper was opened and the chloroform was collected in a beaker of 100 ml size and the chloroform was evaporated to dryness on a water bath in the hood. The produced crystals were recrystallized by ethanol (95%) where caffeine is soluble in the heated ethanol and the crystals were separated by cooling and filtering through the Buchner funnel. The crystals were washed with 5 ml of ethanol. The caffeine crystals were transferred into a crucible and left in a desiccator for one day for drying and weighing.

3. Result and Discussion

Different varieties of tea samples (local tea, China green tea (NAPT), Kabbos,Wazzah, and Lipton Yellow Label) on the studies resulted the following observations showed in the followed table :

Table (1): Concentrations (ppm) of elements in the studies samples of tea leaves.

Types of tea	Concentration of element(ppm)			
local tea	sodium	potassium	calcium	flour
China green tea (napt)	123.4	317.4	83.3	0
Kabbos	95.8	241	98.3	0
Wazzah	6.5	62.0	20.0	0
Green label tea (Lipton)	17.5	70.5	27.6	0
	16.0	13.6	6.90	0

The amount of metals in the studies samples of tea leaves was determined from tea samples by Flame photometer model BWB Technologies UK LTD. The amount of sodium was highest in local tea was equals approximately (123.4 ppm) while was least in the Kabbos was equals approximately (6.5 ppm). The amount of potassium was highest in local tea was equals approximately (317.4 ppm) while was least in the Lipton Yellow Label was approximately (13.6ppm). The amount of calcium was highest in China green tea(NAPT) equals approximately (98.3ppm) while was least in the Lipton Yellow Labe was equals approximately (6.90ppm). The amount of flour was zero in all the studies samples of tea leaves. Concentrations (ppm) of elements in the studies samples of tea leaves was showed in **Figure (1)**.

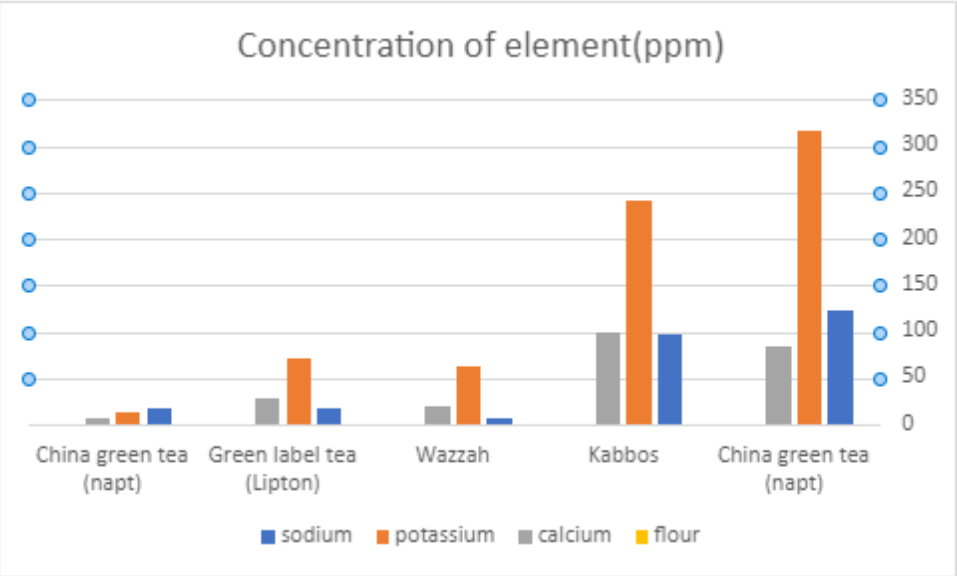

Figure (1): Concentrations (ppm) of elements in the studies samples of tea leaves

The amount of Caffeine in the studies samples of tea leaves (local tea, China green tea (NAPT), Kabbos, Wazzah, and Lipton Yellow Label) on the studies resulted the following observations Caffeine contents in the studies samples of tea leaves was showed in the followed table :

Table (2): Caffeine contents in the studies samples of tea leaves.

Types of tea leaves	Local tea	China green tea(napt)	kabbos	wazzah	green label (Lipton)	Lipton YellowLabel
Caffeine content(g)	0.413	1.484	2.6	2.1	0.44	0.55

The caffeine content was extracted from tea samples and was observed the following: The maximum content of caffeine was found in Kabbos and less content and the caffeine wasfound in local tea. According to the obtained results, the samples Kabbos and Wazza exhibited high antioxidant activity more than the other analyzed studies samples of tea leaves Caffeine contents in the studies samples of tea leaves was showed in **Figure (2)** .

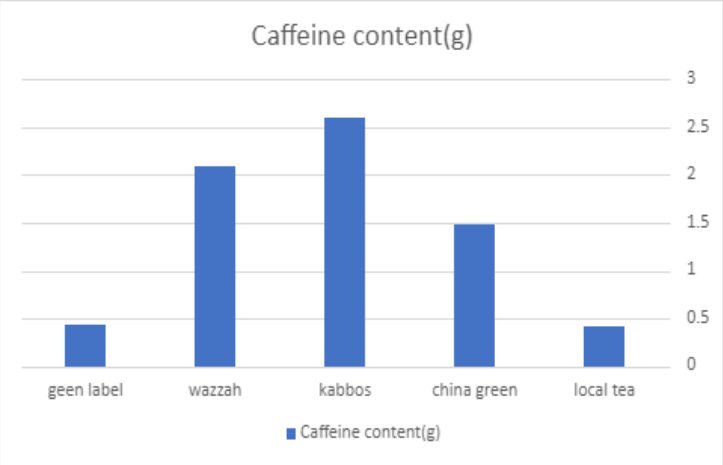

Figure (2): Caffeine contents in the studies samples of tea leaves

4. Conclusion

The analysis results show that tea serves as one of the sources of human intake of various metallic elements, which are essential for humans up to certain levels, of course, the effects of other compounds present in the beverages have also to be taken into account in order to determine the amount of these beverages that should be taken. Where it was found that the value of sodium and potassium was higher in the local tea sample and the caffeine value was lower in the local tea sample. The results of the study also proved that it is possiblefor tea to grow in southern Libya, and therefore we recommend establishing future laboratories and factories for the production of tea with high-quality specifications, as itworks to save economically and reduce foreign imports.

5. References

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