Study on Nutritional Values and Elemental Contents of Tea Leaves Samples (Local Made)

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Abstract

After water, tea is the second most widely consumed beverage in the world and plays a role in intake of nutritional. It is also used in folk medicine for headache, digestion, diuresis, enhancement of immune defiance, as an energizer and to prolong life. This research presents the study on the nutritional values and elemental contents of three types of tea leaves samples (local made). Nutritional values were analyzed by standard AOAC method and elemental analysis was carried out by Atomic Absorption Spectroscopic method. Knowing the nutritional value of foods can help people make the right dietary choices. From the result findings, the high contents of protein were found in all tea samples. According to AAS method, selected tea samples were found with the valuable composition of elements. The ranges of the essential elements in percentage are calcium (7.99 to 1.91), potassium (2.91 to 1.20), magnesium (0.62 to 0.44), while the range for trace elements in mg/g are copper (7.36 to 10.93), iron (180.38 to 320.04), manganese (104.78 to 117.85) and zinc (21.17 to 40.00). The observed values of toxic metal such as lead, cadmium and arsenic in all the samples analyzed are agreed with the allowed permissible limit as approved by WHO.

Keywords: Tea leaves, nutritional values, elemental contents, AOAC, AAS

Introduction

Tea is also one of the most cost-effective beverages available. All tea comes from two varieties of the tea plant called *Camellia sinensis* (a smaller leafed plant) or *Camellia sinensis* assamica (a larger leafed plant).The two *Camellia sinensis* plants are native to South and Southeast Asia, but are grown all over the world in tropical and subtropical environments. Black tea, Oolong, Green and White tea all come from the two varieties of tea, but are processed differently and exposed to different levels of oxidation. Black, green and oolong teas represent 78 %, 20 % and 2 % of world tea consumption, respectively. While all of these teas originate from the same plant, their chemical composition varies depending on geographical location, agricultural practices, processing methods and degree of maturation (Ruxton, 2013).

The tea plant, *Camellia sinensis* belongs to the natural orders. Theaceae or Temstromiaceae has been cultivated since time immemorial so that the origin of it as a wild plant is still a matter of speculation. Tea is one of the oldest known medicines. It was consumed in China 5000 years ago for its ability to stimulate, detoxify, improve the immune system, improve blood and urine flow, and reduce joint pain (Dufresne and Farnworth, 2000). Tea may prevent cigarette smoke-induced oxidative damage and consequent degenerative diseases. Black tea prevents the degradation of red blood cells and protein membranes due to oxidative stress (Halder and Bhaduri, 1998). Black tea has been shown to have anticancer activity in different types of cancers (oral, esophageal and gastric, intestinal, prostrate, lung, breast, skin, liver, urinary tract) (Sharma and Rao, 2009). Black tea improves oral health by inhibiting the growth of bacteria and reducing the incidence of dental cavities. Thus, it can be used as a natural treatment for periodontal disease (Sen and Bera, 2013). In addition, black tea consumption has been shown to reduce cholesterol levels.

Botanical Aspect of Tea Plant

Myanmar name	-	Lepphet
English common name	-	Tea
Botanical name	-	*Camellia sinensis* (Linn.)
Family	-	Theaceae

Figure 1. Photograph of *Camellia sinensis* L. (Green tea leaf)

• (b) (c)

Figure 2. Photographs of (a) Green tea (b) Black tea (c) fermented tea

Materials and Methods

Three types of Commercial dried tea leave samples (local made) were collected and stored in Polyethylene bags under refrigeration. Nutritional values of three types of tea leaves sample were determined by AOAC method (AOAC, 2000). The contents of some metal (Ca, Mg, K, Cu, Fe, Mn , Zn , Pb, As and Cd) in three types of tea leaves samples were determined. The content of Mn, Fe, Zn, Cu, Co, Pb, Cr, Ni and Cd in tea samples were determined by using acid digestion followed by FAAS. The content of K was determined by Flame Photometer at Universities' Research Centre (URC), University of Yangon.

Results and Discussion

This study is focused on analysis of nutritional values (such as moisture content , protein content, crude fiber ,crude fat contents , ash content and carbohydrate) and elemental contents ((Ca, Mg, K, Cu, Fe, Mn , Zn , Pb, As and Cd) of three types of tea leaves samples. The experimental results were shown in Tables 1- 4.

Nutritional Values of Tea Leaves

Moisture content in tea is an important indicator of quality and shelf life. Moisture content in commercial tea is an essential parameter of quality. Three types of tea leave sample contain more moisture percentage up to 8% which can have negative effect on shelf life of the product. According to literature, for the better quality of the product moisture percentage should be controlled between 2.5-6.5 %.

Ash content, which represents total mineral content of different tea leaves, varied between9.59 % and 11.32 %. Ash content represents the total mineral content in foods. Determining the ash content may be important for several reasons. It is a part of proximate analysis for nutritional evaluation. Ashing is the first step in preparing a food sample for specific elemental analysis. Because certain foods are high in particular minerals, ash content becomes important. Ash content of tea is also an important quality parameter. There is positive relationship between ash content and keeping quality of tea and ash content should be controlled less than 5.54% in order to maintain quality of tea during storage. In this research, the ash percent of three tea leave samples are between 9.59 % and 11.32 %.

The protein contents of three types of tea leaves were determined by micro Kjeldahl and Conway diffusion method. The protein contents of dried fermented tea leave sample were shown in Table 1 and Figure 3.

The crude fiber of foods depresses the digestibility of other organic nutrients. The fibrous constituents of plant foods are found in the cell walls, enclosing the available nutrients. In this study, the fiber content was determined by acid-base treatment. The results were obtained by the standard comparison method. The fiber content in three tea leaves samples were found in the range of (10.19 % - 14.32 %).

Lipid is also necessary though lipids are not major constituents in a tea brew but they can play an important role in the development of aroma and has an impact on nutritional profile of tea. The highest amount of Fat contents in fermented tea may be during processing. These results are in line with previous study of Rehman *et al.*, (2002) who suggested 0.95-1.62% fat content for better quality of the commercial tea samples. The fat contents of dried tea leave sample were shown in Table 1 and Figure 3.

Total carbohydrate content of foods has, been calculated by difference, rather than analysed directly. Under this approach, the other constituents in the food (protein, fat, water, alcohol, ash) are determined individually, summed and subtracted from the total weight of the food. This is referred to as total carbohydrate by difference and is calculated by the formula:

100 - (weight in grams [protein + fat + water + ash + alcohol] in 100 g of food).

It should be clear that carbohydrate estimated in this fashion includes fiber, as well as some components that are not strictly speaking carbohydrate, e.g. organic

acids. Total carbohydrate can also be calculated from the sum of the weights of individual carbohydrates and fiber after each has been directly analyzed. The data were shown in Table 1 and clearly seen in Figure 3.

Table 1. Nutritional Values of Three Different Types of Tea Leaves

Sample	Moisture (%)	Ash (%)	Protein (%)	Crude (%)	Fat (%)	Carbohydrate (%)
Black tea leave	8.00	11.32	27.81	10.19	1.16	41.52
Green tea leave	9.02	11.37	30.23	10.72	1.26	37.4
Fermented tea leave	7.38	9.59	17.37	14.32	2.38	48.96

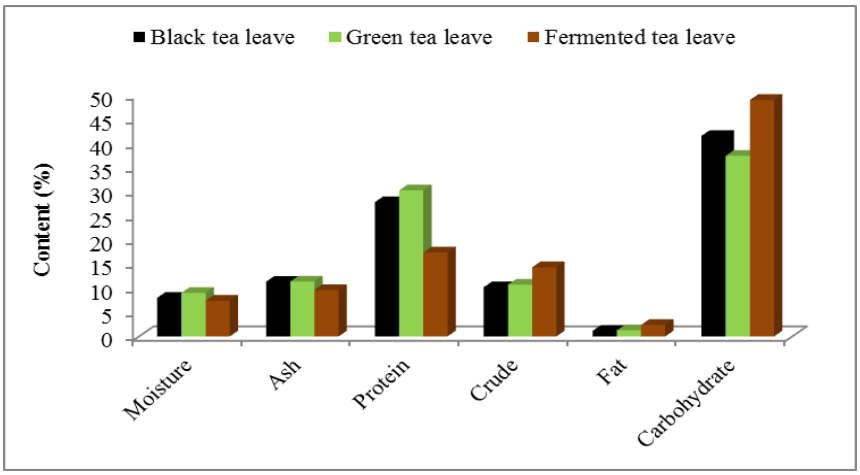

Figure 3. Nutritional values of three different types of tea leaves

Elemental Analysis of Tea Leaves Samples

In the present study, the content of Ca, Mg, K, Fe, Zn, Cu,Mn, Pb, As and Cd in three types of tea samples has been determined by using AAS. Objective of the research was to evaluate the metal contents in locally available some brands of tea. The obtained result showed that tea plant has ability to accumulate metals particularly K, Mn, Na and Fe and to a lesser extent, Zn and Cu. The most abundant element found in tea has been K. Among the heavy metals, lead (Pb), cadmium (Cd) and arsenic (As) are especially toxic and are harmful to humans even at low concentrations. For toxic heavy metals content, the results show that the level of lead, cadmium and arsenic in all the samples analyzed were well within the permissible limits of 10, 0.3 and 10 mg/kg respectively. Above the permissible level can cause high blood pressure, fatigue, as well as kidney and neurological disorders. Heavy metals are also known to cause harmful reproductive effects. The elemental contents of tea leaves sample were shown in Tables 2-4 and Figures 3-5 respectively.

Table 2. Mineral Content of Tea Leaves Samples

Sample	Ca (%)	Mg (%)	K (%)
Black tea leave	7.99	0.62	2.91
Green tea leave	2.57	0.33	0.90
Fermented tea leave	1.91	0.44	0.20

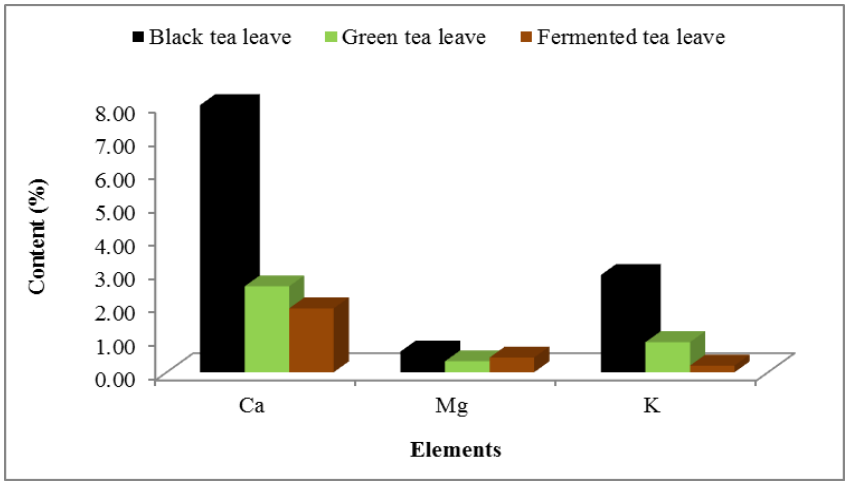

Figure 4. Mineral elements of three different types of tea leaves

Table 3. Trace Element Content of Tea Leaves Samples

Sample	Cu (g /g)	Fe (g /g)	Mn (g /g)	Zn (g /g)
Black tea leave	9.160	180.38	114.64	21.17
Green tea leave	7.360	320.04	104.78	40.00
Fermented tea leave	10.93	258.76	117.85	30.66

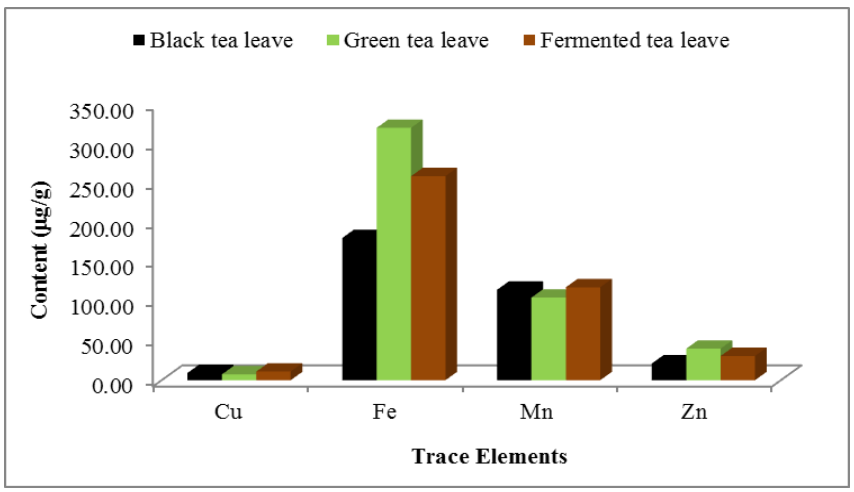

Figure 5. Trace elements of three different types of tea leaves

Table 4. Toxic Metal Content of Tea Leaves Samples

Sample	Pb (g /g)	As (g /g)	Cd (g /g)
Black tea leave	0.21	0.031	0.94
Green tea leave	0.117	0.040	0.25
Fermented tea leave	0.042	0.043	0.17

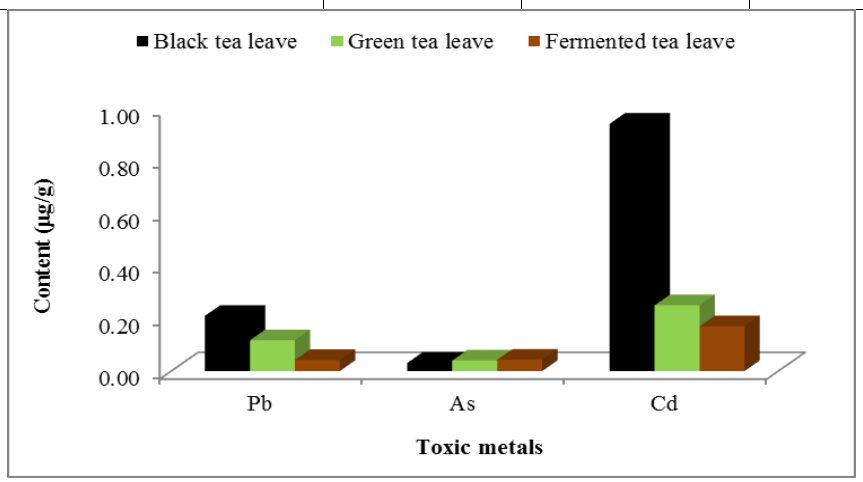

Figure 6. Toxic metals of three different types of tea leaves

Conclusion

Nutrients are the constituents in food that must be supplied to the body in suitable amount. This project presents the study on the nutritional values and elemental content of three type of tea leaves samples (local made) collected from Southern Shan State. Tea is rich in natural antioxidant activities and is reported to have great potential for the management of various types of cancers, oral health problems, heart disease and stroke, and diabetes and to have other health benefits such as the ability to detoxify, improve urine and blood flow, stimulate, and improve the immune system. So, this paper gives some information of the chemical constituents in various types of tea leaves. Green tea was found to have the highest amount of protein content and the least concentration was found in fermented tea. Ca was more abundant than K in all the brands of tea tested and black tea had the highest value 7.99 %. The high ash contents suggest that, the various teas can serve as good sources of minerals. The ash content of black tea, green tea and fermented tea are 11.32 %, 11.37 %, 9.59 % respectively. Moisture content can vary from one tea to the other, depending on the drying time and nature of the tea involved. The moisture content ranged from 8.00 % in black tea, 9.02% in green tea and 7.38% in fermented tea leaves samples. The range obtained in this study is higher than the 5.60 to 7.50 % range reported by Mohammed and Sulaiman (2009). The crude fat content ranged from 1.16 % in black tea, 1.26 % in green tea and 2.38 % in fermented tea. In this study, the teas analyzed are high in N and ash contents, which suggest that, the teas can be rich sources of minerals. The results show that the level of lead, cadmium and arsenic in all the samples analyzed were well within the permissible limits of 0.05 mg kg^{-1} for As and Pb; 0.02 mg kg^{-1} for Cd in non-alcoholic beverages (excluding juice) respectively. Trace elements in various plants can be a useful guide in the determining the safety of a particular plant for human consumption. The results of this study revealed that, the levels trace metals in

various tea brands consumed in Myanmar are below the upper limits set by International Organizations.

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