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Research article

Appraise the physio-chemical quality of Black Tea available in the local market of Chattogram

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ABSTRACT

As a food with a set of standards, it is of paramount importance to develop and maintain the black tea at least to meet the minimum requirements. Hence to obtain a better understanding of quality aspects, the study was carried out to assess the physio-chemical attributes of three branded black tea samples available in the local market of Chattogram, Bangladesh.The moisture, water extract, total ash, insoluble acid ash, water-soluble ash,and alkalinity of water-soluble ashof the tea samples were found to be in the range of 3.32-4.03%, 6.81-8.90%, 31.01-32.46%, 0.30-1.05%, 45.98-66.46%, and 1.99-2.97% respectively. All the obtained data were analyzed statistically to determine the level of significance of variations in observations. Two out ofthree branded tea samples were identified to be satisfactory in terms of tested physio-chemical parameters. Results from the present study can be used further to standardize different black tea brands available in the local markets.

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1. INTRODUCTION

Tea is the oldest and cheapest health beverage in the world next to water (Rahman et al., 2013).It is the processed leaves of *Camellia sinensis*,which, upon infusion with cold or hot water, gives a non-alcoholic beverage (Sharma et al., 2005). Due to its taste, the refreshing, and stimulant effect, it is the most consumed beverage around the world. It has to turn out to be afundamental part of our cultural events, political summits, and everyday life. Depending upon production and processing techniques, tea is categorized into green tea, white tea (both are unfermented), oolong tea (semi-fermented) and black tea (fully fermented) (Petersonet al., 2005). In comparison with other varieties, black tea is highly popular (Ren et al., 2013). It is known to as common base tea and widely preferred as a breakfast tea. Black tea is generally stronger in flavor than other teas. Itis the premiumvariety of fully fermented tea prepared by crushing, tearing, and curling (CTC) operations (Vuong et al., 2011).In this process,oxidation turns the leaves from green to a dark brownish-black color.Many people consume black tea for alertness and energy. It contains caffeine and a little bit of an intoxicating substance called theophylline. Both of the elements can speed up our heart rate, thus making usfeel more vigilant. Black tea is also full of hale and hearty substances like polyphenols, vitamins, caffeine, and

antioxidants (Ludwig et al., 2012). The inspiring health benefits of black tea include lowering the risk of heart attack, cardiovascular disease, boosting immunity, diabetes, high cholesterol, kidney stone, and Parkinson's disease (Sharangi, 2014;Xionget al., 2015).

Rapid assessment of tea quality is an essential step in supply chain management. According to Gill et al. (2011), factors that determine the qualityof made tea includes the plucking method, fermentation time, sorting, and particle size. Generally, tea quality is determined by biochemical approaches. These quality parameters depend on the composition and concentration of several biochemical constituents (Arachchiet al., 2011; Dutta, 2013). The role of international standards is to specify the plant sources from which black tea is to be manufacturedand set requirements for specific chemical characteristics, which, if met, are an indication that the tea has been subjected to ethical production practices. However, ISO standards have been established for black tea to ensure the acceptable quality of the products. Hence, appraising the physio-chemical quality of black tea is a timely need to identify their acceptability as per ISO standards, which would be beneficial to both manufacturers and consumers. There are multiple types of black tea and teabrands available in the local markets of Chattogram city having variationin their composition and quality, but so far as the literature review is concerned; only a comparative study on the qualitative status of five major marketed brands of tea of Bangladesh was carried out. With keeping this in mind, a laboratory experiment was carried out to screen out the physio-chemical quality ofthree popular marketed brands of black tea available in the local markets of Chattogram city.

2.MATERIALS AND METHODS

Sample collection

Samples (bought twice and split into three) of three different brands (MA, Belview, Class One) of black tea were collected randomly fromlocal markets in Chattogram, Bangladesh; the selection was made based on the brand's popularity and likeness among people. Collected samples were kept in the airtight jar to prevent theincorporation of moisture and air.

Moisture Determination

Black tea samples were dried under controlled temperature until a constant weight is obtained. Moisture content was then expressedas per dry weight basis.

$$\text{Moisture content} = \frac{W2-W1}{W} \times 100\%$$

Where,

w_1= wt. of the dried sample with crucible

w_2 = wt. of the sample with crucible

w = wt. of sample

Water Extract Determination

According to ISO (1574:1980), Extraction of soluble matter from the test portion of the sample through water boiling under reflux, filtration, and evaporation of the filtrate to dryness and weighing of the residue.

$$\text{Water Extract} = \frac{(W2-W1)\times 250\times 100}{W\times 25}$$

Where,

w_1 = wt. of the empty dish

w_2 = wt. of the dish with sample

w = wt. of sample

Total Ash Determination

According to ISO (1575:1987), this method involves the oxidation of all organic matter by burning in a muffle furnace at a specified temperature (<550^{0}C). The residue left after incineration is the ash content of the sample.

$$\text{Total ash} = \frac{W3-W2}{W2-W1} \times 100\%$$

Where,

w_1 =weight of the crucible

w_2 =weight of crucible + sample

w_3 = weight of crucible + ash

Acid Insoluble Ash Determination

According to ISO (1577:1987), this method involves treatment of the total ash with 2:5 HCL acid solutions, heating for 20min, filtration with filter paper, washing the filter paper with distilled water to free HCL, placing it in the oven at 105^{0}C temperature, ignition and finally weighing of the residue.

Acid insoluble ash $= \frac{m2-m}{m1-m} \times 100$

Where,

m_2 = lowest mass of the dish with the acid insoluble ash

m = Mass of the empty dish

m_1 = Mass of the dish with dried material

Water Soluble Ash Determination

According to ISO (1576:1988), this method involves the extraction of the total ash with hot water, filtration through ashless filter paper, ignition and weighing of the residue to determine the insoluble ash; calculation of the soluble ash by difference.

Water-insoluble ash in total ash $= \frac{m1-m2}{m1} \times 100$

Where,

m_1 = mass of total ash

m_2 = mass of water-insoluble ash

Alkalinity of Water Soluble Ash

According to ISO (1578:1975), filtrate from the water-soluble ash was titrated with standard 0.1N HCL solution, using methyl orange as an indicator until the color turns from light orange to dark orange or red color.

The alkalinity of water-soluble ash =

$$\frac{Burettereading \times 0.1 \times 0.0561 \times 100}{wt.\ sample}$$

Where,

The concentration of HCL =0.1 N

Strength of KOH is 0.0561

Statistical analysis

Data obtained for each parameterswere laid open to one-way analysis of variance (ANOVA) using Minitab (Version 18.1) Statistical Software followed by Fisher's LSD test to distinguish statistical differences among them to test the level of significance ($p<0.05$).All the experiments were done in triplicate, and data were presented as mean±SD.

3. RESULTS AND DISCUSSION

Data regarding the physio-chemical analysis of commercial branded black tea samples are depicted in Table 1. Moisture content is an essential quality parameter of commercial tea. The maximum value of moisture content was found to be 4.03% (Class One), and the minimum amount was found to be 3.32% (MA) and showed the following sequence: Class One>Belview>MA. According to the ISO standards, black tea generally contains moisture at about 1-5% of its dry weight. The average range of moisture content in black tea is 3.3-4.8% (Ahmed et al., 2013), which is in full agreement with the results of the present study.According to Teshome et al. (2013), higher the moisture content, the lower the shelf life of the teas. So the keeping quality of brand-1 (MA) would last longer,and this moisture level would notpose any threat to microbial contamination.Water extract of tea is dependent on many components,including sugars, phenolic compounds, alkaloids, amino acids, and many other minor soluble substances.There are other factors on which the amount of water extract of tea is dependent, which includes tea and water ratio, the temperature of the infusion, type, particle size, and constituents of the drink (Yao et al., 1992; Patwardhan et al., 2018). According to ISO standards, it should not be less than 32% of the dry weight basis. All the tested samples, except Brand-2 (Belview) fell within the rules. The result is also in line with the findings of (Yao et al., 2006).

Higher ash content in tea results in less moisture content, whereas less ash content in tea might occurs due to adulteration using extracted raw material for the production of tea, which leads to the inferior quality of tea. The maximum value of ash content was found to be 8.9 % (Belview), and the minimum amount was found to be 6.81 % (Class one) and showed the following sequences: Belview>MA>Class One. According to ISO standards,the range of ash content in black tea is about 4-8%. Except for brand-2 (Belview), all the branded tea samples fell within the scope of 4-8% without too much deviation from the recommendationby ISO standards for total ash of tea samples. Previously researchers indicated a positive relationshipbetween ash content and keeping quality of tea (Ismail et al., 2000; Rehmanet al., 2002)

Table 1: Physio-chemical properties of three marketed brands of tea.

Sample	Moisture	Water extract	Total ash	Acid insoluble ash	Water-soluble ash	The alkalinity of water-soluble ash
Brand-1 (MA)	3.32±0.21	32.46±0.15	7.62±0.38	0.93±0.24	53.88±0.36	1.99±0.10
Brand-2 (Belview)	3.93±0.32	31.01±0.36	8.09±0.27	1.05±0.15	46.98±0.17	2.97±0.32
Brand-3 (Class One)	4.03±0.18	32.03±0.23	6.81±0.10	0.30±0.22	66.46±0.22	2.26±0.21

Low water-soluble ash content usually indicates an inferior quality tea that may arise due tousing mature leaves. The water-solubleash contents of all the samples were within the recommended ISO standards (minimum 45%).

Besides, acid insoluble ash content is used for determining the number of silica matters present in tea, which might be contaminated during the manufacturing process, except for brand-2 (Belview), the acid-insoluble ash values of all the branded tea samples complied with ISO standards (maximum 1%). More than 75% of the total potash present in tea leaves is lostby brewing. That's why the alkalinity of the water-soluble ash is an indispensable guide to determine the quality aspects of tea. The alkalinity of water-soluble ash in all thebranded samples was reported to be satisfied withthe ISO requirements (1-3%). Considering all these parameters, the results of the present study is supported by the findings of Alam et al.(2015).

4. CONCLUSION

Therefore, the present study delivers better insights regarding the quality of branded black tea available in the local markets of Chattogram, Bangladesh. According to ISO recommendations, all the tested samples except brand-2 (Belview) showed satisfactory results in terms of physio-chemical attributes. Hence, the manufacturers should be concerned to meet the ISO requirements and standards to ensure the quality and preserving mass public health.In the future study, some other biochemical and stimulating constituents can be studied with more extensive variations for the better assessment of the quality of black tea.

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