ZANCO Journal of Pure and Applied Sciences
The official scientific journal of Salahaddin University-Erbil
https://zancojournals.su.edu.krd/index.php/JPAS

ISSN (print):2218-0230, **ISSN (online):** 2412-3986, **DOI:** **http://dx.doi.org/10.21271/zjpas**

RESEARCH PAPER

Evaluation the Nutritional Status of Imported Tea Brands in Erbil City.

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A B S T R A C T:

A laboratory study was conducted to determine the nutritional composition of the various tea brands that were imported into Erbil city. The tea samples included 12 most popular tea brands purchased in various local market and tea shopping with five replications. The design of experimental based on a CRD. The results were indicated that the concentration of (P, N, K and Ca%) in all tea samples were ranged between (0.0350-0.1288, 1.0127-5.8086, 0.0028-0.0275 and 0.1306-0.8891) respectively. The concentration of Mn in tea brands were ranged between (0.0075-0.0325%), the higher concentration recorded in brand2. The loading rotation with Principal axis factoring was conducted to assess the underlying structure for the thirteen variables on the quality and quantity of tea brands. Two factors were selected, based on the validity that the variables were designed to index two constructs quality and quantity. The result of factor analysis revealed that the first factor responsible on 23.38% of the variance, the second factor accounted for 15.56% of the variance. The recorded eigenvalues were 3.040 and 2.035 for F_1 and F_2 respectively.

KEY WORDS: Tea; Nutrients composition; Essential elements; Caffeine.
DOI: http://dx.doi.org/10.21271/ZJPAS.32.3.19
ZJPAS (2020) , 32(3);187-192 .

1.INTRODUCTION :

The very common most popular drinking in several countries around the world is tea and it is increasing in demand due to the increase in consumption, the widespread consumption of tea around the world due to its aromatic, taste, smell and, above all, its beneficial effects on health, Moreover, it's a cheap drink, so tea is considered a second drink after water and has been expanded worldwide, thus tea becomes a part of the human lifestyle. The quantity and quality of tea production are related to a range of environmental factors, including soil fertility, soil management and climate conditions. The chemical components of tea are the object of extensive scientific studies, so the appropriate estimation of the nutrient components of teas is very important in limiting the quality of tea which health depended. (Hollman et al., 1996). The composition of tea leaves were studied methodically. The polyphenol group was the main constituents of tea leaves which involved 25±35% on a dry weight basis (Balentine et al., 1997 and Hara et al., 1995). In addition to phenol compounds the tea also contains protein, caffeine, and various kinds of vitamins like A, B and vitamin C. Tea also provides large amounts of nutrients like potassium, manganese, calcium, iron and fluoride ions to the drinking. A round the world different papers were published internationally on the organic and inorganic composition of teas, specially the nutrition status of tea by (Ferrara et al., 2001; Christiane and Edward 2001; Alberti et al.,2003; Shu et al., 2003; Mokgalaka et al., 2004; Kumar et al., 2005 ; Mehmet et al., 2008; Seenivasan et al., 2008 and Czernicka et al.,2017). The concentration of elements Ca, Na, K, Mg, and

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Received: 01/10/2019
Accepted: 10/12/2019
Published: 15/06 /2020

N, expressed by mg/g level, while the concentration of elements Cr, Fe, Co, Ni, Cu, Zn, and Cd expressed by µg/g (Cao et al., 1998). A large quantity and quality of tea are consumed by the Kurdish population, thus a huge and different tea brands imported from several countries to meet the growing demand, with out assessment the nutritional status, in particular, the essential composition of imported tea plants. Therefore, it is necessary to assess the level of essential elements of imported tea with regard to their permissible limit. Thus this study aimed to assess the nutritional status of some common brands of tea imported to Kurdistan region.

2. MATERIALS AND METHODS

2.1 Experimental design

The tea samples included 12 most common tea brands purchased in different local market and tea shopping with five replications. The experimental designed in a completely randomized (CRD). Oven drier at 65°C was used for drying the samples, then dried samples were digested using acid digestion mixture H_2O_2 and H_2SO_4 acid (1/1 , v/v). The N percentage was measured by the Distillation, and the P concentration was determined by the by spectrophotometric method while the flame photometric method of Allen (1974) were used to determined K and Ca. The digested samples were used to determine the concentration of Fe, Cu, Mn and Zn by atomic absorption flame emission spectrophotometry. (Michael et al., 2008). The caffeine concentration was estimated by using high-performance liquid chromatography (HPLC). The determination, pure caffeine was used for preparation standards curve (Hollman et al.,1996). The total carbohydrate and volatile and ash were determinate according to methods described in (Allen ,1974).

2.2 Statistical analysis

Data were statistically analyzed using SPSS version 24. All data expressed as a mean value. The difference among the means of tea brands was compared by applying Duncan multiple comparison tests at (5%) level of significance, the results were subject to the factor analysis (principal component analysis and discriminate measure). (Steele and Torrie, 1969 and Cirocka et al., 2016).

3. RESULTS AND DISCUSSION

The data analysis revealed that the mean values described large difference among selected brands of tea. Table 1 present mean finding related to the nutrients in the selected tea brands, the statistical analysis show a significant differences of nutrients among tea brands accept the Zn show no significant differences. The content of macroelements (P, N, K and Ca%) in all tea samples were ranged between (0.0350-0.1288, 1.0127-5.8086, 0.0028-0.0275 and 0.1306-0.8891) respectively. The highest contents of P, N, K and Ca were found in tea brands (7, 11, 3 and 4), while the lowest contents of the same macroelements were recorded in brands (5, 3, 11 and 3) respectively. This discrepancies of minerals content among tea brands may be related to the variation among the tea kinds, harvesting time, soil types and climate properties. Michael et al., (2005) revealed that the concentrations of K and Ca were ranged between (1.77-2.48) and (0.062-0.182) respectively in the black teas. The studied tea brands were showed large ranges values of K and lower range value of Ca compared to the ranges obtained in the study was carried out by (Michael et al.,2005) . This variation in Ca content may be related to soils properties, climate condition of the cultivation tea farms. The high concentration of Ca is important because of its role in the formation of teeth, bone and muscles. The higher levels of N and P in the studied tea plants explained on the ground that these elements are greatly translocated from old leaves to young leaves due to their higher mobility Marschner (1995). Also Kumar et al., (2005) estimated a higher concentration of K in tea leaves and they interpreted their result on the bases that the K able to binding with some organic compound which facilitate its translocation in the tea leaves. The concentration of Mn in tea brands were ranged between (0.0075-0.0325), the higher concentration recorded in tea brand 2 this result is lower than that reported by Micheal et al., (2008) in black tea , while higher than the range has been reported by Czernicka et al., (2017) in China black tea . The concentration of iron in teas under study was located within the range of (0.0121-0.024%) being highest in brand 6 (0.0182%) lower range of iron has been reported by Micheal et al., (2008) in black tea. While the concentration of Cu ranged between (0.002-0.0085%). Wang et al., (1993) indicate that the concentration of Cu was ranged from 9.6 to 20.9 mg/kg, (0.00096-0.0020%) in Chinese tea brands, which are lower than the values obtained for the studied tea brands. The result of many studies indicated that essential elements play a vital role in human metabolisms, particularly in growth, development, preventing healing the disease. Iron is an important element of the human body, because of participation in oxygen and electron transport, and it is necessary for the formation of the hemoglobin.

Table 1. Range and mean value of essential elements in different tea brands

Tea brands	Essential elements %							
	P	**N**	**K**	**Ca**	**Mn**	**Fe**	**Cu**	**Zn**
1	0.053d	3.122bc	0.0059cd	0.714ab	0.0128de	0.0177a	0.0023c	0.00730a
2	0.076bc	2.074de	0.0052cd	0.718ab	0.0245a	0.0161abc	0.0032c	0.00660a
3	0.113a	1.446e	0.0193a	0.144e	0.0127de	0.0128c	0.0024c	0.00683a
4	0.073c	4.177b	0.0083c	0.822a	0.0225ab	0.0155abc	0.0035c	0.00660a
5	0.052d	3.630bc	0.0065cd	0.595bc	0.0222ab	0.0145abc	0.0030c	0.00683a
6	0.087bc	4.141b	0.0142b	0.273de	0.0229ab	0.0182a	0.0035c	0.00587a
7	0.119a	2.658cd	0.0157b	0.385d	0.0147c	0.0168ab	0.0056b	0.00697a
8	0.087bc	3.908b	0.0082c	0.177de	0.0192abc	0.0171ab	0.0055b	0.00563a
9	0.089b	3.711bc	0.0063cd	0.606bc	0.0208ab	0.0149abc	0.0026c	0.00677a
10	0.076bc	3.409bc	0.0042d	0.565c	0.0091e	0.0165abc	0.0037c	0.00673a
11	0.045d	5.209a	0.0033d	0.244de	0.0082e	0.0168ab	0.0059ab	0.00773a
12	0.080bc	3.856b	0.0048cd	0.574c	0.0188bc	0.0134bc	0.0072a	0.00660a
Grand Mean	**0.079**	**3.445**	**0.0085**	**0.485**	**0.0174**	**0.0158**	**0.0040**	**0.00671**
Sd	**0.0229**	**1.0915**	**0.0053**	**0.2316**	**0.00596**	**0.0023**	**0.0017**	**0.0012**
Minimum	0.0350	1.0127	0.0028	0.1306	0.00750	0.0121	0.0020	0.0043
Maximum	**0.1288**	**5.8086**	**0.0275**	**0.8891**	**0.03250**	**0.0240**	**0.0085**	**0.0095**

The data analysis in table 2 refers to the significant differences among tea brands for protein, volatile, caffeine, ash and total carbohydrate ($P<0.05$). Among the chemical composition, the caffeine and total carbohydrate are most abundances, their concentration ranged between (12.00-45.44% and 13.735-53.492%) respectively, the high content of caffeine and total carbohydrate (38.037% and 49.764%) recorded in tea brands (7 and 3) respectively. Czernicka et al., (2017) has reported that the caffeine concentration in China black tea was ranged between (31.5-43.42), which are lower than the value of most studied tea brands. The value of (protein =31.063, volatile=3.357 and ash=6.723) were recorded in tea 9,12 and 4 respectively, The concentration of protein, volatile and ash were higher compared to those were reported by Czernicka et al., (2017) in China black tea. The discrepancy in the nutrients content of different brand teas may be related to the variation in the soil characteristics and the environmental condition of the countries tea production, in addition to the genetic and physiological variation among the tea brands.

The loading rotation with principal axis factoring was conducted to evaluate the influence of the thirteen variables on the quality and quantity of tea brands. Two factors were selected, based on the validity that the variables were designed to index two constructs quality and quantity. The result of factor analysis figure.1 revealed that the first factor responsible on 23.38% of the variance, the second factor accounted for 15.56% of the variance. The recorded eigenvalues were 3.040 and 2.035 for F1 and F2 respectively.

Table 2. Range and mean value of chemical composition in different tea brands

Tea brands	Protein %	Volatile %	Caffeine %	Ash %	Total Carbohydrate %
1	10.360f	2.504bc	29.177ab	5.173bcd	38.784ab
2	12.720e	2.520bc	35.275ab	3.297e	33.737b
3	6.773h	2.840bc	23.247c	6.277b	49.764a
4	9.743gf	2.593bc	33.203ab	6.723a	33.027bc
5	8.007gf	2.443bc	37.550a	5.953abc	32.207bc
6	13.542e	2.947ab	33.813ab	4.753cd	32.413bc
7	17.667d	2.401c	38.037a	4.757cd	26.038c
8	30.320a	2.353c	29.670ab	5.277bcd	20.989c
9	31.063a	2.533bc	26.833bc	4.790cd	21.519c
10	26.700b	2.429c	23.240c	6.413ab	30.107bc
11	26.277b	2.363c	28.443ab	4.387de	24.284c
12	22.930c	3.357a	24.373c	5.790c	29.316bc
Grand Mean	**18.008**	**2.607**	**30.238**	**5.299**	**31.849**
Sd	**8.788**	**0.364**	**7.541**	**1.108**	**9.667**
Minimum	14.720	2.080	12.000	2.880	13.735
Maximum	**32.000**	**3.650**	**45.440**	**7.650**	**53.492**

The results in figure.1 revealed that the samples of tea lower values of F1 are obviously prominent from teas characterized by higher values of F1. The data analysis in figure 2 show the parameters and factor variation for the rotated factors, with value less than 0.4 omitted to enhance simplicity. The first factor, which seems to index quality, loads most strongly on the concentration of (K, P, N and Ca), with loadings in the first column. The N and Ca contents indexed low quality of tea brands and have negative effect. The second factor, which seemed index quantity, was involved the protein and Cu strongly positive effect on quantity, while the carbohydrate shows negative loading. Moreover, the nitrogen has its highest negative loading from the quantity index but also had a positive loading from the quality index. (Cirockaetal.,2016).

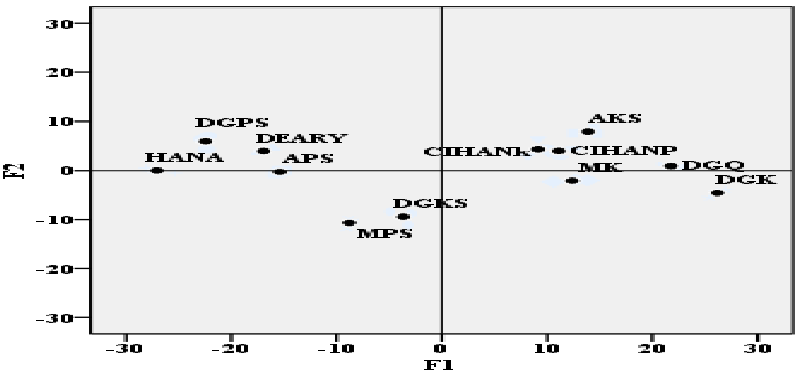

Figure 1. Scatter plot of object of two discriminate function of the all analyses tea samples

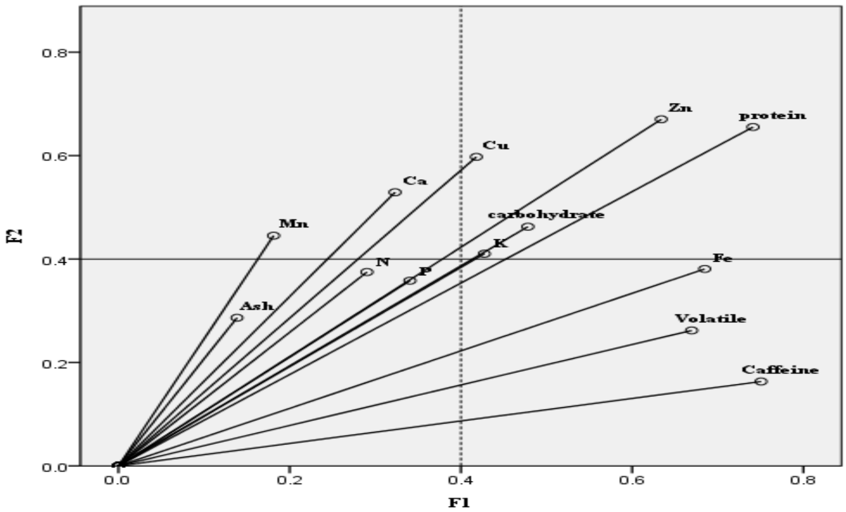

Figure2. Scatter plot of loading for 13 variables of the all analyses tea samples

4. CONCLUSIONS

The statistical analyses show a significant differences of nutrients among tea brands except the Zn show no significant differences. The concentration of Mn in tea brands were ranged between (0.0075-0.0325), the higher concentration was recorded in tea brand 2, while the levels of microelements and macro elements were within the ranged in comparisons with the previous studies except the level of Iron. The concentration of Cu and protein in all tea brands is great importance in respect of quantity, while the carbohydrate shows negative loading. Moreover, the nitrogen has its highest negative loading from the quantity index but also had a positive loading from the quality index. The tea brands 10, 11 and 12 characterized by excellent quality particularly brand 10 .

Acknowledgements

The authors would like to thanks every bodies, for their great assistance and providing all requirements to complete this research.

Conflict of Interest

There is no conflict of interest

References

ALBERTI, G. RAFFAELA B., ANTONELLA P., and MARIA P .2003. Determination of the total concentration and speciation of Al(III) in tea infusions. Journal of Inorganic Biochemistry 97 , 79–88

ALLEN, S. E. 1974. Chemical analysis of ecological materials. Black well scientific publication Osney Mead, Oxford. pp: 64-214

BALENTINE, D. A., WISEMAN, S. A., and BOUWENS, L. C. 1997. The chemistry of tea flavonoids. Critical Reviews in Food Science and Nutrition. 37, 693-704.

CAO, X., ZHAO, G., YIN, M., and LI, J. 1998. Determination of ultratrace rare earth elements by inductively coupled plasma mass spectrometry with microwave digestion and AG50W-X8 cation exchange chromatography. Analyst, 123, 1115–1119.

CHRISTIANE J. D. and EDWARD R. F .2001.A review of latest research findings on the health promotion properties of tea. Journal of Nutritional Biochemistry. 12, 404–421

CIROCKA J. B., MAŁGORZATA. G and PIOTR S .2016. Analytical Assessment of Bio-and Toxic Elements Distribution in Puerh and Fruit Teas in View of Chemometric Approach Biol Trace Elem Res 174,240–250

CZERNICKA M. GRZEGORZ Z., MARCIN B., BOGDAN S., and CZESŁAW P .2017. Study of nutritional value of dried tea leaves and infusions of black, green and white teas from chinese plantations Rocz Panstw. Zakl Hig 68(3),237-245

FERRARA, L., MONTESANOA, D., and SENATORE, A. 2001. The distribution of minerals and flavonoids in the tea plant (Camellia sinensis). II Farmaco, 56, 397–401.

HARA, Y., LUO, S J., WICKREMASHINGHE, R. L., and YAMANISHI, T. 1995. Chemical composition of tea. Food Reviews International, 11, 435-456.

HOLLMAN, P. C. H., HERTOG, M. G. L., and KATAN, M. B. (1996). Analysis and health effects of flavonoids. Food Chemistry, 57, 4-46.

KUMAR, A., NAIR, A. G. C., REDDY, A. V. R., and GARG, A. N. 2005.Availability of essential elements in Indian and US tea brands. Food Chemistry, 89, 441–448.

MARSCHNER, H. 1995. Mineral nutrient of higher plants (2nded.). London: Academic Press.

MEHMET M., O ZCAN A., AHMET U., NVER A., TOLGAUCAR B, and DERYA A. 2008. Mineral content of some herbs and herbal teas by infusion and decoction. Food Chemistry 106 , 1120–1127

MICHAEL YEMANE A B.S. CHANDRAVANSHI B.,AND TADDESE WONDIMU C. 2008. Levels of essential and non essential metals in leaves of the tea plant (Camellia sinensis L.) and soil of Wush farms, Ethiopia. Food Chemistry 107, 1236–1243

MOKGALAKA, N. S., MCCRINDLE, R. I., and BOTHA, B. M. 2004. Multielement analysis of tea leaves by inductively coupled plasma optical emission spectrometry using slurry nebulization. Journal of Analytical Atomic Spectrometry, 19, 1375–1378.

SEENIVASAN S, MANIKANDAN N, MURALEE DHARAN NN,and SELVASUNDARAM R. 2008.Heavy metal content of black teas from South India. Food Control 19,746–749.

STEEL, R.G.D. and TORRIE, J.H. 1969. Principle and Procedures of Statistics. McGraw Hill, New York.481pp

W.S. SHU, Z.Q. ZHANG, C.Y. LAN and, M.H. Wong .2003. Fluoride and aluminium concentrations of tea plants and tea products from Sichuan Province, PR China Chemosphere 52, 1475–1482AKTER, M.