A COMPARATIVE ASSESSMENT OF TEA AND COFFEE AS SOURCES OF SOME ESSENTIAL MINERALS IN THE NIGERIAN DIET

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Abstract
Five widely consumed brands of tea and five coffee products were examined for their mineral content levels in comparison with 10 brands of multivitamin and mineral capsules; 10 brands of bottled mineral waters; 10 natural fruits widely eaten in Nigeria and 10 vegetable food species in most Nigerian diets, to ascertain their respective contributions to essential minerals required for healthy growth. The comparisons revealed that tea and coffee contain significant essential minerals in quantities that could serve as alternative dietary source of the body requirements for essential minerals.
Keywords: Tea, Coffee, Essential Minerals, Nigerian diet.

INTRODUCTION

Minerals are nutrients found in foods, which are similar to vitamins and are just as essential for good health. They are a part of all cells, tissues, muscles and fluids in the body and are needed for a verity of chemical processes that take place within the body. Most people are aware of the importance of a diet that is rich in vitamins and their functions in the body. However, people are not so knowledgeable about minerals and their purpose towards good health.

The dietary focus on chemical elements derives from an interest in supporting the biochemical reactions of metabolism with the required elemental components (Lippard *et al.,* 1994). Appropriate intake levels of certain chemical elements have been demonstrated to be required to maintain optima health (Cambridge, 1995). Many elements have been suggested to be essential, but such claims have usually not been confirmed. Definitive evidence for efficacy comes from the characterization of a biomolecule containing the element with an identifiable and testable function. Major elements (or minerals) are considered major because they are required by the body in doses of 100mg/day or greater than 0.01% of bodyweight (Anke *et al.,* 1984). Minor elements (or minerals) are required by the body in amounts less than 100 mg/day, i.e less than 0.01% of body weight and could be referred to as trace minerals or trace essential elements (Di-Bona *et al.,* 2011). Major elements (or minerals) are calcium, phosphorus, potassium, sodium, chloride, magnesium and sulfur. Minor elements (or trace minerals) are chromium, cobalt, fluoride, zinc, selenium, silicon, boron, iron, copper, iodine manganese, molybdenum, nickel, arsenic and vanadium.

Daily intake of tea and coffee of a representative population in New Zealand have been studied by Gullies and Birkbeck (1983). The result of that study indicated that tea and coffee remained a very good source of manganese and potassium and that coffee is a better source of potassium than tea and under simulated intestinal conditions was about 40% bioavailable, indicating that New Zealand tea products may be important dietary source of manganese.

Tea is one of the most consumed beverages in the world, just as coffee. It is prepared from the leaves of the shrub Camellia sinensis (Saud and Al-Oud, 2003; Fernandez Caceres *et al.,* 2001; Powell *et al.,* 1998). Considering that an estimated amount of 18 20 billion tea and coffee cups are consumed daily worldwide, its economic, social and dietary interest is clear (Fernandez Caceres *et al.,* 2001; Kirk-Othmer, 1995). Several attempts have been made by many researchers to assess tea quality by chemical analysis usually with reference to pigmentation and flavouring characteristics, little or less work has been done to identify the mineral components of tea (Saud and Al-Oud, 2003). Metallic minerals in tea leaves and roasted coffee beans are normally different according to their type and geographical sources (Marcos *et al.,* 1996; Sahito *et al.,* 2005).

The quality of tea brands and herbs available in retail market in the Kindom of Saudi Arabia, were assessed based on contents of metallic minerals in them (Saud and Al-Oud, 2003). All tested brands of tea and herbs possessed considerable amounts of eight minerals viz: Mn, Fe, Zn, Cu, Ni, Co, Pb and Cd. Tea and coffee in Nigeria have been found to contain both essential and non-essential (or toxic) trace elements at varying degree of concentrations (Okere, 2011). Elements that are essential for body metabolic processed, have also been found in both tea and coffee by many workers in recent times (Okere, 2011; Gallia *et al.,* 2010; Pair *et al.,* 2011; Tadayon and Lahiji, 2011).

According to Tadayon and Lahiji (2011), availability of essential elements in tea samples from Iran surpass their non-essential counterparts and may have contributed to the mineral requirements to human diet in Iran. Elements such as Cu, Zn, Fe, Mn and Na were found in significant amounts in the tea brands sampled. Because there is little information on the contribution of tea and coffee to mineral nutrients intake of Nigerian, the aim of this comparative mineral content level assessment of tea and coffee products in Nigeria, is to relate the findings of mineral concentrations in them with other known sources of minerals in diet and food, so as to predict if tea and coffee consumption could serve as alternative sources of certain essential mineral nutrients in the Nigerian diet.

MATERIALS AND METHODS

5g, each of tea, coffee, vegetable and were separately digested with 10ml (12M) HNO_3, followed by 5ml (60%) H_2O_2 at 5 minutes interval. The samples with digestion reagents, were gradually heated to 120^oC in a fumes of No2 gas disappears completely from the digestion flask. Complete decomposition of all samples was achieved at 150^oC for 2h. The resulting supernatant solutions were cooled to room temperature (25^oC), labelled, and kept for AAS determination (Buck Scientific AAS model 210, equipped with single slot burner and air-acetylene flame). Other samples, mineral waters and mineral capsules were not subjected to any analytical treatments as the values of the mineral contents on their packaging labels were used for comparison of results. Validation of analytical results were as reported by Okere (2011). The brand names of teach and coffee products are as reported earlier by Okere (2011). Actual brand names were left to avoid legal infractions.

RESULTS AND DISCUSSION

The concentrations of essential and non-essential minerals found in tea and coffee in Nigeria were found to be in the following decreasing order; Zn ($12.9mgkg^{-1}$), Cu ($1.40mgkg^{-1}$), Fe ($0.44mgkg^{-1}$), Mn ($0.22mgkg^{-1}$), Cr ($0.32mgkg^{-1}$) and Pb ($0.26mgkg^{-1}$); for tea and Zn ($13.0mgkg^{-1}$), Cu ($1.5mgkg^{-1}$), Fe ($0.10mgkg^{-1}$), Mn ($0.15mgkg^{-1}$), Cr ($0.40mgkg^{-1}$) and Pb ($0.20mgkg^{-1}$) for coffee (Table 1). A copious and constant consumption of tea and coffee will provide essential minerals to the body outside other dietary sources of these metals. The average values of Zn found in tea (12.9mgg-1) and coffee (13.0mgkg-1) were higher than those obtained for selected vegetables (0.23mgkg-1), (Table 2) fruits (0.11mgkg-1), Table 3, and mineral capsules (5.0mgkg-1) (Table 4), but less than the value found in mineral waters (20mgkg-1) (Table 5), in the Nigerian market.

Generally, the results of Zn concentration in tea and coffee were higher than the values from fruits, vegetables and mineral capsules suggesting that tea and coffee beverages are better providers of Zn as essential minerals to the body. The Acceptable Daily Intake (ADI) (WHO/FAO, 2001) for Zn is 20mgkg-1/day and these were in agreement with dietary regulatory standard for Zn found in tea and coffee (12.9mgkg-1 and 13.0mgkg-1), respectively compared favourably with the values reported by Zoetman and Brinkman (1975), for tea only, in Europe, which was between (10.0-15.0mgkg-1); Gillies and Birkbeck (1983), in New Zealand, with values ranging from 11.0 to 12.0mgkg-1 (Table 7).

Zinc is present in every cell in the body and also in hair, nails and skin (Pamplona-Roger, 2006). It is needed to maintain a healthy immune system, which can help in keeping colds and flue at bay. It is necessary for a healthy reproductive system, normal growth and reduces the levels of fatigue, skin problems and sore throat (Pamplona-roger, 2006). A lack of Zn in the diet is quite uncommon; however, symptoms include more cold and flu bunts, longer healing wounds, a lesser sense of taste and smell, skin problems, loss of appetite and night blindness (Pamplona-Roger, 2006).

Copper in tea samples ($1.4mgkg^{-1}$) and coffee samples ($1.5mgkg^{-1}$) (Table 1) were higher than those recorded for mineral waters ($0.5mgkg^{-1}$), but was lower than the level of Cu in mineral capsules ($6.0mgkg^{-1}$), (Table 4). The results for Cu in fruits and vegetables were not stated in Tables 2 and 3. However, the values found in mineral waters suggesting that tea and coffee will provide Cu to the body as what is derived from mineral waters found in the Nigerian market. The Acceptable Daily Intake (ADI) for Cu human body in given as 0.9mg/day, while the Recommended Daily Allowances (RDAs) by the German Society of Nutrition 2006; stipulated a value of 1.0mg/kg/day/female from the ages of 25-50yrs, coffee beverages in Nigeria conformed to International ADI and RDA standards (Table 7).

Comparing the values Cu obtained in tea and coffee with other findings elsewhere, showed that the recorded values of $1.4mgkg^{-1}$ (tea) and 1.5mgkg-1 (coffee) were within the values reported by Gilles and Birbeck (1983) in New Zealand which gave a range of 0.08-1.90mgkg for tea samples analyzed (Table 7). Cu levels found in present study in tea samples ($1.4mgkg^{-1}$) was higher than the values recorded by Saud and Al-Oud (2003) which was 0.16mgkg-1 and the value reported by Karimi *et al.,* 2008 ($0.52mgkg^{-1}$) in Saudi Arabia and Iran, respectively. Copper helps to form collagen, which is essential for health bones and connective tissue. It is important for the production of red blood cells and is needed to absorb iron more readily. Research suggests that copper may prevent heart disease and high blood pressure and that it protects against damage from free radicals and the development of cancer (Pamplona-Roger, 2006). Symptoms of Cu deficiency include weakness of body, skin and breathing problems.

The mean concentration of Fe in tea was 0.44mgkg^{-1} and 0.1mgkg-1 in coffee samples (Table 1) and these were close to the average values obtained for vegetables (0.6mgkg^{-1}) (Table 2) and fruits 0.24mgkg^{-1}, (Table 3). However, the average concentration of Fe in multivitamin and mineral capsules (15.0mgkg^{-1}) (Table 4) and those found in mineral waters (5.0mgkg^{-1}) (Table 5), were higher than the quantity of Fe found in tea and coffee, but thse are not consumed daily compared with tea & coffee. Tea samples which are naturally rich in Fe (0.44mgkg^{-1}), than coffee samples (0.1mgkg^{-1}), may be recommended to recuperating anaemic patients, since Fe levels in tea is higher than values found in fruits and vegetable (Tables 1,2 and 3).

The National Academy of Sciences, USA. Recommended 18.0mg/kg/day of Fe for both men/women between the ages of 25-50 years. The quantities of Fe found in tea and coffee samples compared with the brands found in Iran (Lipton brands), by Tadayon and Lahiji (2011). Also, the mean Fe content of sampled tea ranged from 0.21-0.41mgkg^{-1} (coffee) and this was comparable to the value obtained in Nigeria which was 0.44mgkg^{-1} (tea) and 0.1mgkg-1 (coffee). Iran is required for the production of haemoglobin, the component of red blood cells that transport oxygen around the body. It is also needed to produce myoglobin, which carries oxygen to our muscles. Iron prevents fatigue, protects against illness and disease and promotes a healthy looking skin. Iron deficiency sometimes experienced by women with heavy periods, vegetarians and athletes, could be managed by regular and copious consumption of tea which contains significant amounts of Fe. The recommended dietary requirements for Fe is about 18.0-20.0mgkg^{-1}/day (Muller, 1998) (Table 6), but only about 10.0mgkg^{-1} is absorbed by body tissues (Muller, 1998). In the present study, the quantity of iron is given as between 0.3-055mgkg^{-1}, in tea samples, while its value is between 0.09-0.11mgkg^{-1}, in coffee samples (Table 1). This result has significant implications for guarantee affordable but steady supply of Fe as a body mineral nutrient. Iron is very essential to human nutrition (Mark *et al.*, 1983), but excessive doses of Fe over a long period of time can cause disturbances of the blood stream and liver serosis (Graniza *et al.,* 2005).

The levels of Cr found in tea was 0.32mgkg-1, with a range from 0.2-0.8mgkg-1, and that of coffee was 0.40mgkg^{-1}, with a range from 0.2-0.5mgkg^{-1} (Table 1). The amount of Cr found in vegetables (Table 2), fruits (Table 3) and mineral capsules (Table 4), were not stated. However, the average quantity of Cr found in mineral waters consumed in Nigeria is given as 0.02mgkg^{-1}, with a range from 0.01-0.04mgkg^{-1} (Table 5). The amount of Cr in tea (0.032mgkg^{-1}) and coffee (0.mgkg^{-1}) are higher than those found in mineral waters (0.02mgkg^{-1}) and as such, tea and coffee will serve as a better source of the body's dietary requirement for chromium. Chromium has been described as non-essential to mammals but recent studies have implicated Cr with some role in sugar metabolism in human (Di-Bona *et al.,* 2011); (Eastmond *et al.,* 2008). There is currently, market for the supplement of chromium pucolinate, though precise and definitive biochemical evidence for a physiological function of chromium is still lacking (Stearns, 2000).

Table 1: Results of analyses of average mineral contents of tea and coffee in Nigeria

Tea Samples	Minerals (mg/kg)					
(N=5)	Zn	Cu	Fe	Mn	Cr	Pb
Mean±sd	12.9±1.5	1.4±0.5	0.44±0.1	0.22±0.2	0.32±0.2	0.26±0.1
Range	(10.0-15.0)	(1.0-2.0)	(0.3-1.55)	(0.18-0.35)	(0.2-0.8)	(0.1-0.45)
Coffee samples (N = 5)						
Mean±sd	13.0±0.1	1.5±0.5	0.1±0.1	0.15±0.1	0.4±0.1	0.2±0.1
Range	(9.0-15.0)	(1.0-1.6)	(0.09-0.11)	(0.1-0.16)	(0.2-0.5)	(0.1-0.3)

N: Number of samples analyzed ($N_{(total)}$ = 10); Source: Okere (2011)

Table 2: Average concentration of minerals in selected vegetables (mg/100g)

Vegetables (N=10)		Minerals					
		Ca	Mg	Fe	K	Zn	Na
Onion		20.0	10.0	0.22	1.58	0.19	3.0
Pepper		9.0	10.0	0.46	177	0.12	2.0
Tomato		5.0	11.0	0.51	204	0.07	10.0
Yam		17.0	21.0	0.54	816	0.24	9.0
Cabbage		47.0	15.0	0.59	246	0.18	18.0
Carrot		27.0	15.0	0.50	323	0.20	35.0
Cucumber		14.0	11.0	0.26	144	0.20	2.0
Green beans		37.0	25.0	1.04	209	0.24	6.0
Lettuce		36.0	6.0	1.10	290	0.25	8.0
Okra		81.0	57.0	0.80	303	0.60	8.0
	Mean	29.3	18.1	0.60	286.9	0.23	10.4
	Range	(5-81)	(6-57)	(0.22-1.10)	(144-816)	(0.07-06)	(2.0-35.0)

N: Number of vegetables sampled; Source: Pamplona-Roger (2006)

Table 3: Average concentration of minerals in selected fruits (mg/100g)

Fruits (N=10)		Minerals					
		Ca	Mg	Fe	K	Zn	Na
Banana		6.0	29.0	0.31	396	0.16	1.0
Grape		11.0	6.0	0.26	185	0.05	2.0
Guava		20.0	10.0	0.31	284	0.23	3.0
Mango		10.0	9.0	0.13	156	0.04	2.0
Orange		40.0	10.0	0.10	181	0.07	-
Paw-paw (Papaya)		24.0	10.0	0.10	257	0.07	3.0
Pineapple		7.0	14.0	0.37	113	0.08	1.0
Plantain		3.0	37.0	0.60	499	0.14	4.0
Tangerine		14.0	12.0	0.10	157	0.24	1.0
Watermelon		8.0	11.0	0.17	116	0.07	2.0
	Mean	14.3	14.8	0.24	234.4	0.11	2.1
	Range	(3-40)	(6-37)	(0.1-0.6)	(113-499)	(0.04-0.24)	(1.0-4.0)

N: Number of fruits sampled
Source: Pamplona-Roger (2006)

Table 4: Mean and range of levels of minerals from nutritional labels on 10 multivitamin and mineral capsules in the Nigerian market

Mineral Supplements	Concentration (mg/kg) on Labels
Fe	15.0+(15 – 15.76)*
Cu	6.0+(2.0 – 8.0)*
Mg	40.0+(4.0 – 66.34)*
Mn	2.0+(1.0 – 3.0)*
Zn	5.0+(5.0 – 7.5)*
Ca	17.0+(15.3 – 18.0)*
K	1600+(1000 – 1800)*
Se	27.0+(25.5 – 35.0)*
Cr	Ns
Na	1500+(1000 – 2000)*

* = Range of concentrations of minerals supplements
+ = Mean concentrations of minerals supplements
Ns = Not stated

Table 5: Average contents of essential minerals from mineral waters in the Nigerian market

Minerals	Mean concentrations (mg/L)*
Ca	1200(400 – 1500)$^{+}$
Cr	0.02(0.01 – 0.04)$^{+}$
Cu	0.50 (0.1 – 0.7)$^{+}$
Mg	200.0 (100 – 400)$^{+}$
Mn	1.2 (0.8 – 1.5)$^{+}$
Fe	5.0(2.0 – 8.0)$^{+}$
Pb	0.001(0 – 0.001)$^{+}$
Na	1200.0 (800 – 1500)$^{+}$
Zn	20.0 (5.0 – 25.0)$^{+}$
K	2500.0 (1000 – 4000)$^{+}$
Se	0.20 (0.1 – 0.4)$^{+}$

* = Average contents of 10 sampled mineral waters and metal contents on their nutritional labels
+= Range of minerals in parenthesis

Table 6: Mean concentration of metals (mg/kg) in various samples compared with ADI and RDA standards

Mean	Tea	Coffee	Vegetables	Fruits	Mineral waters	Mineral capsules	ADI (WHO/FAO)	RDA (Germ)	RDA (NAS, USA)
Zn	12.9	13.0	0.23	0.11	20.0	6.0	15.0	15.0	20.0
Cr	0.37	0.4	-	-	0.02	-	0.4	0.4	0.5
Fe	0.44	0.10	0.60	0.24	5.00	15.0	15	18	18
Mn	0.22	0.15	-	-	1.20	2.0	2.3	2.3	2.3
Cu	1.40	1.50	-	-	0.50	6.0	0.9	1.0	1.0
Pb	0.26	0.20	-	-	0.001	-	0.01	0.01	0.01
Mg	-	-	18.1	14.8	200.00	40.0	400	420	420
Ca	-	-	29.3	14.3	1200.0	17.0	800	1200	1300
Na	-	-	10.4	2.1	12000.0	1500.0	1200	1500	1500
K	-	-	186.9	234.4	2500.0	1600.0	4500	4700	4700
Se	-	-	-	-	0.02	0.27	0.02	0.055	0.055
Co	-	-	-	-	0.01	-	0.01	0.01	0.02
Cd	-	-	-	-	0.001	-	0.3	0.3	0.3
Ni	-	-	-	-	0.01	-	0.01	0.02	0.02

ADI (WHO/FAO) = Average Daily Intakes (WHO/FAO Working Group, 1992), Food Standard Programme
RDA (Germ) = Recommended Daily Allowances (German Society of Nutrition, 2006)
RDA (NAS) = Recommended Daily Allowances (National Academy of Sciences, USA, 2006)
-= Not determined
RDA values found in (Encyclopedia of Foods and their Healing Powers, Editor: Pamplona-Roger 6th edition, Vol. 2, pp 17 – 19) 2006.

Table 7: Comparison of results with studies on mineral concentration in tea and coffee samples from other countries

Method of Preparation			Metal concentrations (mg/kg)					
	Sample concentrations (g/L)	Infusion time (min)	Cu	Zn	Fe	Mn	Reference	Country of Origin
	10	5	0.17	2.4	<0.02	1.8	Stag and Millan (1975)	Sweden
	20*	5	0.03 – 0.07	0.9 – 0.11	0.03 – 0.1	0.92 – 2.5	Varo et al. (1980)	Finland
Infusion Tea Samples (all)	10	2 – 10	Trace	Trace	†	Trace	European Mkt Data & Statistics	England
	5	+	0.10	10.01 – 15.0	+	1.0	Zoetman and Brinkman (1975)	Europe
	12 – 5	2	0.08 – 1.90	11.9 – 30.0	0.10 – 0.17	2.0 – 2.2	Gillies and Birkbeck (1983)	New Zealand
	5	10	1.0 – 2.0	12.0 – 15.0	0.30 – 0.35	0.15 – 0.35	Okere (2011)	Nigeria
	Ns	#	†	†	8.0	9.0	Schroede (1974)	USA
	8.5	†	0.16 0.48	11.0 – 12.0	0.24 – 0.30	0.14 – 0.15	Gellies and Birbeck (1983)	New Zealand
Brewing Coffee Samples (all)	60*	†	0.03 – 0.06	0.1 – 0.18	0.54 – 0.69	0.48 – 0.69	Varo et al. (1980)	Finland
	21.0	10.0	0.06 – 0.88	0.17 – 0.18	0.11 – 0.33	0.02 – 0.16	Gillies and Bribeck (1983)	New Zealand
	5.0	10.0	1.0 – 2.0	12.5 – 13.5	0.09 – 0.11	0.14 – 0.16	Okere (2011)	Nigeria

* = de-ionized water; † = Not detected or trace; # = Stirred until dissolved; Ns = Not stated; Source: Gillies and Birbeck (1983).

The average dietary allowance for Cr has not been stated, but chromium that is allowed in mineral waters has been limited to a value not more than 0.05mgkg.

This figure (0.05mgkg-1) for Cr in mineral waters could serve as a guide for its recommended dietary allowance (RDA) for males and females within the ages of 25 – 50 years (Table 6). The amount of Cr in tea (0.32mgkg-1) and coffee (0.4mgkg-1) exceeded the allowable limits for mineral water (0.05mgkg-1) and a recommended dietary intakes of between 0.04-0.05mgkg-1 by Hui, 1992. Expected chromium toxicity may not occur because most tea and tannins that exude these metals at high temperatures as precipited metal tannin chelates which may ultimately lead to decrease in metal concentration in tea and coffee (Atta et al., 2000). Chromium is a trace element that is important in the body. It is able to stabilize blood sugar levels, which could prevent diabetes the good cholesterol in the body while lowering the bad cholesterol. Symptoms of physiological deficiency or lack of chromium could bring on the problem of diabetes as well as raise blood cholesterol levels and can lead to heart disease (Di Bona et al., 2011).

The average concentration of Pb in tea and coffee samples were given as 0.26mgkg-1 and 0.20mgkg-1, respectively. (Table 1). The value of Pb in vegetables (Table 2), fruits (Table 3) and mineral capsules (Table 4), were not listed. However, the average quantity of Pb found in mineral waters in Nigeria is 0.001mgkg-1 (Table 5). The high concentration of Pb in tea and coffee was probably due to environmental pollution or as a result of human activities in the vicinity of the plantations and land area where mining industrial wastes or effluents rich in Pb, accumulate. The average amount of Pb in tea and coffee imported from 10 countries varied from 1.90-4.2mgkg-1 (Gillies and Birbeck, 1983), and these figures were much higher than those reported in this study. Tea plant is normally grown in acidic soils where Pb is more bioavailable for root uptake. Deposits from polluted air into the leaves of the plant can be another source of Pb contamination of tea (Han et al., 2006). The average daily intake (ADI) of Pb had been pegged at 0.01mgkg-1 (Pamplona-Roger, 2006), as well as its recommended daily allowance (RDA), NAS, 1989. Although the World Health Organization (WHO) has fixed maximum permissible level in dry mass of medicinal plants for Pb at 10mgkg-1 (WHO, 1999), plants actually have the ability to decrease the toxicity of compounds by changing their biochemical from (Huang et al., 2000). In the present study, though the value of Pb in tea and coffee is higher than the ADIs and RDAs stipulated (Table 6), the amount of Pb in tea and coffee beverages may just be enough to furnish the body's requirement of Pb for healthy living.

Mineral salts such as Na+, K+, Ca2+, Mg2+, Cl, P, S, F and I were not considered in tea and coffee assays in the present work, because they are known to be in macro (large) levels in most plants and vegetation generally. For a complete (or total) mineral composition of tea and coffee brands in Nigeria, future efforts will be directed towards the quantification of all 'macro' and 'micro' inorganic constituents of tea and coffee beverages consumed in Nigeria.

CONCLUSION

The values of the mineral contents of tea and coffee have been shown in be significantly high enough to serve as alternative sources for the healthy living. This is against the backdrop of the fact that when compared with other dietary sources of minerals in food, continuous and copious consumption of tea and coffee will supply the body's requirements for some essential minerals for metabolic activities. The differences in the values obtained (when compared with studies elsewhere), may have been as a result of the nature of plant species, soil characteristic and the contents of minerals in soil at tea or coffee plantations prior to harvest and processing. Comparison with recommended daily allowances and acceptable daily intakes, including values found in fruits, vegetables and other mineral supplement products revealed that tea/coffee contain minerals well enough to serve as a dietary source to human populations. Since the economy of many citizens in Nigeria may not be strong enough to afford vegetables, fruits, mineral capsules and mineral water, tea and coffee that are affordable could serve as quick replacement and are potential sources of dietary minerals required by the body. These findings may have important nutritional implications in countries where tea and coffee are consumed regularly and mineral intakes from other dietary sources are marginal as is the case in Nigeria.

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