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FRACTION OF MINERALS EXTRACTED FROM PARAGUAYAN YERBA MATE (ILEX PARAGUARIENSIS, S.H.) BY COLD TEA(MACERATION) AND HOT TEA(INFUSION) AS CONSUMED IN PARAGUAY

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SUMMARY: The fractions of the minerals (Fe, Ca, Mn, Mg, Na, K, Zn and Cu) that are extracted from a commercial Paraguayan yerba mate (Paraguayan tea) in the process of cold tea and hot tea preparations as are consumed in Paraguay were determined.

RESUMEN: Se determinan las fracciones de minerales (Fe, Ca, Mn, Mg, Na, K, Zn y Cu) que se extraen de la yerba mate (té paraguayo) comercial en el proceso de preparación de té tanto frío como caliente, como suele consumirse en Paraguay.

INTRODUCTION

Early in the 20th century, the apparently extraordinary stimulating and physical endurance enhancement properties of a herb consumed as cold (maceration) and hot (infusion) water preparations by country workmen in Paraguay and neighboring regions of Argentina, Brazil and Uruguay, raised the interest and curiosity of European scientists. The herb was named Ca á (currently, yerba mate or Paraguayan tea) by the natives of the country. The undernourished workers showed an incredible labor and physical work capacity in the plantations and farms where they began work at sunrise and ended at sunset. The active constituent of the herb, initially named mateína (Samaniego, 1927; Grondona, 1954), was proved to be identical to caffeine (Samaniego, 1927; Descartes, 1962; Vázquez et al, 1986 ;

Alikaridis, 1987; Vera García, 1988, 1989). Later, in more recent times (Descartes, 1962; Vázquez et al, 1986; Vera García, 1988), traces of theophylline and theobromine were also found (0.002 and 0.05 % respectively). However, the stimulant caffeine was not sufficient to explain the workers extraordinary muscular efficiency. Consequently, a considerable amount of scientific work has been done searching for the yerba mate chemical composition which has, thus far, identified several organic compounds (Alikaridis, 1987). As stated above Yerba mate cold (maceration) and hot (infusion) water preparations have been widely consumed for centuries in the Southern South America namely Paraguay, Argentina, Brazil and Uruguay, and the remarkable stimulant properties of this "tea" has been well known . However, its possible nutritional properties and its consequent impact on the populations concerned has only been pointed out through recent studies (Tenorio Saenz et al,1991; Vera García et al,1997; Guggliuci,1995).

The extraordinary high mineral content of yerba mate both natural and commercial has turned this beverage into a foodstuff rather than a simple stimulant tea as it has been reg99arded thus far for its high caffeine content. These considerations and the need to know how important a food it can be in the diet of the population that consume it make it necessary to determine how much of the minerals in the commercial preparation is really nutritionally available. Following the generally accepted concept that the minerals in foods that are extracted in water are mostly available, this work has been undertaken with the purpose of determining the fraction of those minerals that actually pass into the cold or hot water of extraction as it is usually performed by the people who consume it.

MATERIALS AND METHODS

1 Chemicals:

The standard solutions of Na, K, Ca, Fe, Mg, Mn, Zn and Cu as well as the hydrochloric acid were purchased from Merck (Germany).

2 Minerals extraction procedures.

A package of a commercial yerba mate reputed as of high quality was used for extraction.

Three aliquots of this product were taken for three different extractions. Minerals determinations were carried out on all three of them in order to have the reference values for the estimation of the extent of the extraction. The extracting procedures were designed so as to replicate as closely as possible the usual way people consume the cold 9tea (called tereré) in Paraguay and the hot tea (mate) in all of Southern South American countries namely Paraguay, Argentina Uruguay and Brazil.

2.1 Cold extraction:

Forty grams of yerba mate whole product (both powder and sticks) were taken from each aliquot into a 250 mL common glass with aluminum straw inserted into the yerba mass. This straw was connected to a filtering flask attached to a vacuum pump. A 1,500 mL volume of cold tap water (8°C) was added to the yerba in the glass as follows: 500 mL in about 100 mL portions with continuous sucking up to 500 mL. After this volume of water was collected the wet mass of yerba was stirred with the straw as is commonly done by consumers every 250 mL twice and every 100 mL also twice and finally with the last 50 mL of water.

2.2 Hot extraction

The procedure is exactly the same as in cold extraction but 1,000 mL of hot water (at 80 ° C) were used this time.

3 Minerals determination:

A Shimadzu Atomic Absorption / Flame Emission Spectrophotometer, Mod. AA-630-12 with individual cathode lamps specific for each mineral, air-acetilene flame system, air compressor with air filter and a water dionizer-distillator were used.

The methods of AOAC and Osborne (AOAC, 1990; Osborne, 1978) modified were applied. Three aliquots of the stated amount of whole yerba were taken for analysis. To 10 mL of every extract 10 mL of HCl were added and filtered into a 100 mL volumetric flask and made up to volume with de-ionized distill water for analysis.. For blank determination, 10 mL of the same tap water was taken into a 100 mL volumetric flask and made up to volume with de-ionized distill water.

4 Moisture determination:

Two five gram aliquots of yerba were taken to the oven at 105 ° C, during 4 h.

RESULTS

The average values of the extracted mineral fractions are presented in the following tables :

TABLE 1

Minerals content in mg/100g of commercial yerba, *I.paraguariensis* (wet basis)

Sample	Fe	Ca	Na	K	Mg	Mn	Zn	Cu
S-1	25.7	654	40.8	1245	335	64.5	10.5	0.893
S-2	24.7	633	39.6	1254	335	66.8	9.8	0.868
S-3	25.7	644	40.2	1288	334	73.5	10.6	0.868
Mean	25.4	644	40.2	1262	335	68.3	10.3	0.876
SD	0.577	10.5	0.600	22.7	0.577	4.68	0.436	0.0144

TABLE 2

Minerals extracted by cold extraction in mg/100g of commercial yerba, *I.paraguariensis* (wet basis)

Sample	Fe	Ca	Na	K	Mg	Mn	Zn	Cu
S-1 a	4.15	121	28.5	1057	136	27.2	4.07	0.429
S-1 b	4.15	119	28.6	1087	134	26.8	4.39	0.429
S-2 a	4.15	126	28.6	928	147	25.3	4.23	0.438
S-2 b	4.15	123	28.5	980	152	26.8	3.76	0.434
S-3 a	4.16	113	34.2	1134	134	27.9	4.54	0.435
S-3 b	4.14	112	34.2	1083	144	27.5	3.92	0.430
Mean	4.15	119	30.4	1040	141	26.9	4.15	0.432
SD	0.00	5.55	2.92	76.4	7.60	0.900	0.292	0.0037
%Extracted	16.3	18.5	75.6	82.7	42.1	39.4	40.3	73.1

TABLE 3

Minerals Extracted by hot extraction in mg/100 g of commercial yerba, *I.paraguariensis* (wet basis)

Sample	Fe	Ca	Na	K	Mg	Mn	Zn	Cu
S-1a	6.29	138	35.8	1152	250	37.1	4.70	0.858
S-1b	6.79	133	36.2	1152	249	37.1	4.61	0.858
S-2a	6.79	129	35.1	1152	228	37.3	5.11	0.856
S-2b	6.79	125	34.9	1185	238	37.1	4.70	0.857
S-3a	6.29	123	35.4	1285	249	37.3	4.40	0.858
S-3b	6.29	113	35.3	1119	250	37.3	4.61	0.858
Mean	6.55	127	35.4	1163	246	37.2	4.68	0.858
SD	0.257	8.68	0.476	58.2	9.10	0.110	0.234	0.0008
%Extracted	25.8	19.7	88.1	92.2	73.0	54.5	45.5	89.7

DISCUSSION AND CONCLUSION

It can be observed that there is a considerable recovery of the minerals in the water of the cold extraction which is remarkably high for K, Na, Mg, Mn, Zn and Cu (82.7, 75.6, 42.1, 39.4, 40.3 and 73.1 respectively). It is noteworthy as well the greater recovery in the hot extraction which is especially higher for Fe, Mg, Mn, and Cu.

These facts make the yerba mate tea an important source of minerals in the diet of those people who drink it considering the great volume usually consumed by them.

The great consumption is due, in the first place, to the habit of doing it and, to the hot climate where those people live.

Assuming that the water soluble minerals are generally available and considering the great amounts of each mineral in the yerba mate (mainly Fe, Ca, K, Mg, Mn, Zn, and Cu), it can be recognized the possible nutritional importance of these high mineral recoveries for the areas where the mentioned yerba preparations are carried out for consumption. This possibility is supported by the usual great volume of the tea consumed by those people due to habit and to the hot climate that predominates in their environment.

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