

ORIGINAL

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PROF-833

HYPER CALCIURIA; INDUCED BY DRINKING CARBONATED BEVERAGES



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ABSTRACT... rfeen_k@yahoo.com **Objective:** To assess the short term effects on urinary calcium excretion of carbonated beverages. **Design:** Case control study. **Setting:** Department of Biochemistry, Basic Medical Sciences Institute, Jinnah Postgraduate Medical Centre, Karachi. **Period:** From Oct 2001 to Dec 2004 **Materials & Method:** Fifty-one normal subjects of either sex age ranged from 20-40 years, with habitual users of carbonated beverages were selected for the study. Their fasting and post-beverage urine samples were analyzed for calcium excretion. **Results:** Out of 51 patients we have observed a significant increase in urinary calcium excretion from that of both caffeinated and non-caffeinated beverages in male subjects ($P < 0.001$). In females more calciuria was found in their fasting samples a reason of non-significant results after beverages consumption. **Conclusion:** The excess calciuria is confined to both caffeinated and non-caffeinated beverages in males. It is suggested that habitual use must be restricted to prevent bone resorption and an early osteoporosis.

Keywords: Carbonated beverages, Calcium

INTRODUCTION

Intake of carbonated beverages was associated with reduced bone mass or increased fracture risk, both later in life¹ and in children and adolescents² Colas were more

strongly associated than were other carbonated beverages. The factors responsible for this association may be due to increase phosphorus intake or net acid load of these beverages that use phosphoric acid as the

acidulent or the caffeine of those beverages that are caffeinated. More recently, fructose found in beverages used as a natural sweetener, was implicated as a possible cause of reduced calcium balance³.

The issue is especially important today because calcium intake falls far short of current recommendations. Per capita carbonated beverage consumption has risen dramatically and carbonated sodas are now the preferred beverages of 20-40 years old women⁴. Interference in the calcium economy of persons with already low calcium intakes would only aggravate any calcium short fall.

Teens have doubled or tripled their consumption of soft drinks and they have cut their consumption of milk by more than 40%⁵. Low bone mineral density is due to genetic, hormonal, or environmental factors, e.g. diet may be causally related to fractures⁶. Calcium and its supplementation have been found to increase bone mineral density⁷. Osteoporotic fractures may be affected by diet and activity among young women⁸.

The simplest example of an acid-ash food product is a cola drink. Since bone is the largest source of buffer in the body, it is likely to participate in the buffering of a cola drink, unless the diet provides adequate buffer. Study has evidence that an acid-ash diet causes excessive calcium loss and a negative calcium balance and that the ingestion of a carbonated buffer reverses this loss and improves the calcium balance⁹.

MATERIALS & METHOD

This proposed study was carried out in the department of Biochemistry at Basic Medical Sciences Institute, JPMC, Karachi. Fifty-one subjects comprising 26 females and 25 males were selected for this study from different areas of Karachi. Age ranged from 20-40 years. All the subjects were habitual users of carbonated beverages. They were non-diabetic, normotensive, having no history of acute or chronic urological problem and no history of renal stones formation. They were educated and briefed about the study protocol.

The subjects excluded were pregnant ladies, lactating mothers, those who were already on calcium therapy and having some gastrointestinal problems.

The beverages offered to each subject were according to following order. A 500 ml of deionized water on the day-1 of study as a negative control; a 500 ml of carbonated beverage containing caffeine on day-2; a 500 ml of carbonated beverage without caffeine on day-3; and a 500 ml of milk on day-4 of the study as a positive control. The subjects were asked to report after an overnight fasting, voiding their first urine sample and after further two hours fasting their first fasting urine sample was collected. They have then given a breakfast of low calcium diet along with a 500 ml of test drink each day. Then After 5 hours pause and without taking any further diet their urine samples were re- collected as a post-beverage sample. These samples were analyzed for the detection of urinary calcium by using a kit, Cat # CA590 of Randox Company. The reducing sugars were passed through benedict's qualitative reagent to exclude their presence. The beverages were also analyzed for the caffeine content and dissolved carbon dioxide from the Laboratory of PCSIR (Pakistan Council of Scientific and Industrial Research) while sodium¹⁰, phosphorus¹¹, calcium, pH, sugars, and dried weight by using traditional chemical methods in the Laboratory of Biochemistry department, BMSI, JPMC, Karachi.

The values of urinary samples of the subjects were divided into two groups as pre-beverage (fasting) and post-beverage samples for all the four groups. The comparisons were made in female vs female, male vs male, and total vs total, while totals of all the four beverages were also compared. Results were analyzed statistically using the student t-test.

RESULTS

The results of the study show the composition and characteristics of the beverages used. All the analyses were performed in the Laboratory of Biochemistry department (BMSI) while caffeine content and dissolved CO₂ were analyzed by the Laboratory of PCSIR, Karachi on providing the beverage samples (Table-I).

Table – 1. Beverages Composition and Characteristics¹

Beverages	Caffeine ² (mg)	Sodium ³ (mEq)	Phosphorous ³ (mmol)	pH ³	Calcium ³ (mmol)	Carbonate ² (dissolved CO ₂)	Sugar ³ (gm)	Dried ³ wt (gm)
Caffeinated	12.60	3	3.78	5.4	-	3393	25	4.57
Non-Caffeinated	-	5	0.008	5.8	-	3393	7.5	2.64
Milk	-	6	15	6.9	15	-	24	6.5
Deionized Water	-	-	-	7	-	-	-	-

¹Content per 500 ml of all beverages

²Obtained from Pakistan Council of Scientific and Industrial Research (PCSIR)

³Determined by analysis in Biochemistry Laboratory of BMSI

TABLE-II COMPARISON OF URINARY CALCIUM_i BETWEEN PRE- AND POST-DRINKS

Urinary samples	Deionized water (500 ml)			Caffeinated drink (500 ml)			Non caffeinated drink (500 ml)			Milk (500 ml)		
	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total
	n=26	n=25	n=51	n=26	n=25	n=51	n=26	n=25	n=51	n=26	n=25	n=51
Pre-beverage	1.51±0.26	1.24±0.21	1.38±0.17	1.51±0.26	1.24±0.21	1.38±0.17	1.51±0.26	1.24±0.21	1.38±0.17	1.51±0.26	1.24±0.21	1.38±0.17
Post-beverage	0.78**±0.13	0.55***±0.13	0.67***±0.09	2.62±0.51	2.38***±0.35	2.50*** φ ^{2,3±0.31}	2.49±0.46	2.81**±0.41	2.65*** φ ^{2,4±0.30}	3.90***±0.44	3.89***±0.54	3.89*** φ ^{2,3,4±0.34}

P<0.01, *P<0.001

When female vs female, male vs male, total vs total pre-beverage compared with post-beverage.

¹ Values are expressed in mmol

²P<0.001 when compared total of Deionized water with total of Caffeinated, Non-caffeinated and Milk

³P<0.001 when compared total of Caffeinated with total of Non-caffeinated and Milk

⁴P<0.001 when compared total of Non-caffeinated with total of Milk.

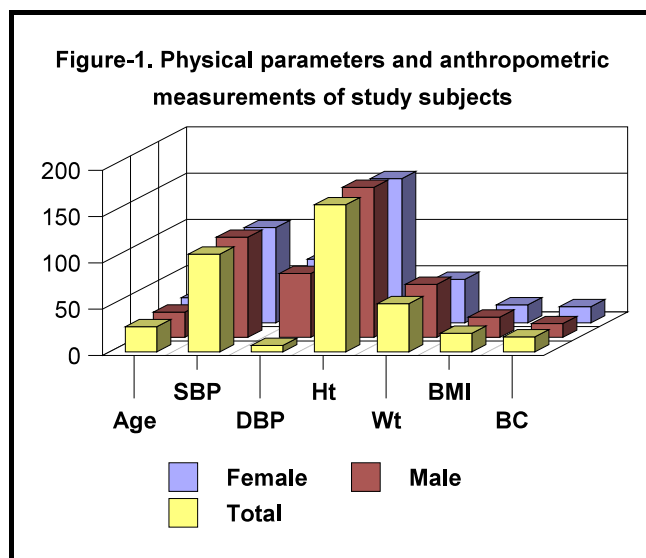
The physiological parameters and anthropometric measurements of study subjects showed no significant change except in the weight (P<0.005) of males which was increased in comparison with females (Fig-1).

The comparison of urinary calcium between pre- and post-drinks showed a logical and obvious significant results with deionized water and milk in all females, males, and their total. The caffeinated carbonated beverages and non-caffeinated carbonated beverages showed significant hypercalciuric effects in males and total subjects while females showed the non-significant

results (Table-II).

DISCUSSION

The studies carried out on the same aspect by others¹² show similar characteristics and composition of beverages used with that of our study but the amount of their ingredients were different from the brand we used, which might also affected our results comparatively. The work performed by others was only on female subjects while we saw the effects on both males and females study subjects. We also combined the same results of both sexes and compared them totally.



We also found the diuretic effects of caffeine and its effect to increase urinary calcium excretion suggested as a risk factor for osteoporosis¹³. The hypercalciuric effects were also confined to increased intake of refined carbohydrates¹⁴ and sodium chloride¹⁵ and the beverages we used also contained sugar and sodium. The hypercalciuric effects in our study were not confined only to the caffeinated beverages but also to the non-caffeinated beverages.

In this study we found the effect of caffeine diuresis of calcium more in male subjects than the females, may be because of the environmental or dietary patterns of our subjects. It is noted that females lose more calcium than males in the pre beverage fasting samples, that is why we have not seen the significant effect of calciuria in females. Although the females have lost more calcium than males in the post-beverage sample. This is confirming our results that the females who are habitual users of carbonated beverages showing a low body mass index which is towards the lean side and may have losing their bone masses early in life.

CONCLUSION

In the light of above study, we came to the conclusions that the habitual and excessive use of carbonated beverages must be reduced and the people must take the recommended daily requirement of calcium to

prevent the negative calcium balance.

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CORRECTION

A The amendment of the Professional Vol:11, No.02 (Prof-745) page 186, Column 2 line 1 are as under;

INCORRECT

Dr. Mohammad Arshad , FCPS
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CORRECT

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B. The amendment of the Professional Vol:09, No.03 (Prof-658) page 261, Column 2 line 1 are as under;

INCORRECT

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C. The amendment of the Professional Vol:11, No.03 (Prof-825) page 334 Column 1 line 10 are as under;

INCORRECT

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