ORIGINAL ARTICLE

URINARY EXCRETION OF ZINC, CHROMIUM, COBALT AND MANGANESE IN HEALTHY ADULTS

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ABSTRACT

Background: It is speculated that trace elements might have specific roles in the pathogenesis and progression towards type-2 diabetes mellitus. The objective of this study was to determine the urinary excretion of zinc, chromium, cobalt and manganese in healthy adults.

Material & Methods: It was a cross sectional study conducted in Institute of Basic Medical Sciences, Khyber Medical University, Peshawar, Pakistan from January 1, 2013 to July 31, 2013. Sample size was 200 individuals selected through convenient technique from seven divisions of Khyber Pakhtunkhwa provence. All adults healthy were eligible for inclusion in the study, while those with diabetes mellitus, hypertension, dyslipidemia, coronary heart diseases, pregnancy, endocrine disorders and malignancies were excluded from the study. Relevant history was recorded on a structured performa. Demographic variables were gender and age in years. Research variables were levels of urine zinc, chromium, manganese and cobalt. All were numeric variables except gender being nominal. Frequencies & percentages for nominal & mean/ sds for numeric variables were calculated.

Results: The mean age of the subjects was 33.39±9.62 years. Out of 200 individuals, 104 were males & 96 females. Urinary excretion of zinc (Zn),chromium (Cr), cobalt (Co) and manganese (Mn) in males was 3.05±2.75 mg/L, 0.89±0.69 μg/L, 1.75±1.48 μg/L and 0.04±0.02 μg/L respectively. While in females urinary excretion of Zn was 3.16±2.84 mg/L, Cr 0.82±0.63 μg/L, Co 1.73±1.19 μg/L and Mn was 0.03 ±0.02 μg/L.

Conclusion: Urinary excretion of zinc, chromium, cobalt and manganese in healthy adults need to be monitored properly to avoid health problems in future.

KEY WORDS: Zinc; Chromium; Cobalt; Manganese.

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INTRODUCTION

In diabetes mellitus, higher quantities of zinc are excreted in the urine. However the deficiencies of zinc can be coped by the increased absorption from the gastrointestinal tract.[1,2] In some uncontrolled diabetic patients, especially those using diuretics, there can be greater losses of glucose in the urine. For such patients it is essential to get Zinc Sulphate supplements in the dose of 220 mg tds for a period of three months.

Chromium is among those trace minerals which is beneficial in regulating levels of glucose in the blood by its action to increase sensitivity of cells to Insulin.[3,4] It is noteworthy that with increasing age, chromium levels decrease in human body[5,6], which indicates that with increasing age, the individual can lead to Insulin resistance diabetes mellitus.[9] Two different studies over chinese have showed the significant role of chromium supplementation in controlling hyperglycemia in diabetics.[7,8]

Organic cobalt is nutritionally and biologically useful. Cobalamin supplements, a source of organic cobalt, is the most important member of vitamin B series. It acts as co-enzyme in most of the biochemical and enzymatic reactions which are taking place during the metabolism of carbohydrates, fats, and proteins. However, cobalt deficiency often occurs due to its inability to absorb from the digestive tract

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rather than its absence in the diet. Low levels of cobalamin commonly leads to tingling of arms/legs, back pain, weight loss, body odor and sore tongue.[9]

Manganese acts as a co-enzyme in many other biochemical and enzymatic processes. Therefore, its level was observed higher in rats and mices with diabetes.[10] It has also been shown that manganese is needed by insulin for its production and secretion. In both animal and human subjects with diabetes, the metabolism and status of iron was found imbalanced.[11] Manganese is the important trace element which also has a very significant role in formation and protection of connective tissues, cartilages, teeth, and bones. The objective of this study was to determine the urinary excretion of zinc, chromium, cobalt and manganese in healthy adults.

MATERIAL AND METHODS

It was a cross sectional study conducted in Institute of Basic Medical Sciences, Khyber Medical University, Peshawar, Pakistan from January 1, 2013 to July 31, 2013. Sample size was 200 individuals selected through convenient technique from seven divisions of Khyber Pakhtunkhwa provence (KPK) i.e. Dera Ismail Khan, Bannu, Kohat, Peshawar, Mardan, Malakand and Abbottabad. Twenty five individuals were selected from each division except Peshawar in which 50 subjects were selected due to being a metropolitan city.

All adults healthy were eligible for inclusion in the study, while those with diabetes mellitus, hypertension, dyslipidemia, coronary heart diseases, pregnancy, endocrine disorders and malignancies were excluded from the study. Verbal consent was sought from all the subjects. Study was also approved from ethical committee. Samples of urine were collected from fasting subjects early in the morning in polyethylene bottles (Italy, Kartell1, Milan) washed with acids to make them sterilized. The bottles were wrapped in a clean polyethylene envelope for storage during the sampling period. 1%v/v HNO_3 ultra-pure concentrated acid was used for acidification of the samples of urine. Then they were stored at 4° celsius. For analysis, each sample was shaken vigorously for at least one minute to get a homogeneous solution before the determination of urinary zinc, chromium, manganese and cobalt. All the samples were run on a an auto analyzer after the calibration and controls materials were run before processing the urine sample of study individuals by atomic absorption spectrophotometer. Relevant history was recorded on a structured performa.

Demographic variables were gender and age in years. Research variables were levels of urine zinc, chromium, manganese and cobalt. All were numeric variables except gender being nominal. Frequencies & percentages for nominal & mean/ SDs for numeric variables were calculated.

RESULTS

The mean age of the subjects was 33.39±9.62 years. Out of 200 individuals, 104 were males & 96 females. Urinary excretion of Zinc (Zn),chromium (Cr), cobalt (Co) and manganese (Mn) in males and females are given as mean and SDs as follows. (Table 1)

Table 1. Gender-wise distribution of urinary trace elements of healthy individuals of KPK (n=200)

Gender	Zn (mg/L)	Cr (μg/L)	Co (μg/L)	Mn (μg/L)
Male	3.05 ±2.75	0.89 ±0.69	1.75 ±1.48	0.04 ±0.02
Female	3.16 ±2.84	0.82 ±0.63	1.73 ±1.19	0.03 ±0.02

DISCUSSION

A study on guinea pigs having manganese deficiency showed that they developed diabetes mellitus. Their offspring were observed with anomalies in their pancreas or pancreas was totally absent in some of them. It also has been proven that the individuals with diabetes mellitus have almost half the level of manganese in their blood as compared to those who are normal.[12] It is speculated that trace elements might have specific roles in the pathogenesis and progression towards type-2 diabetes mellitus.

In this study the urinary excretion of Zn was higher than Italian (0.27-0.85 mg/L)[13], Swedish (0.04-0.78mg/L)[14] and Canadian (0.36-0.60 mg/L)[15] populations. While it was lower than Hyderabad, Pakistan (0.75-0.80 mg/L)[1] and Iran (0.63-0.32 mg/L).

The urinary excretion of Cr in the present study was higher than Italy (0.04-1.5 μg/L), Sweden (0.04-0.3 μg/L)[14] and Canada (0.24-1.8 μg/L).[15] While it was less than Hyderababd, Pakistan (8.5-10.3 μg/L)[1] and Iran (9-7 μg/L).[16]

The urinary excretion of Co in the present study was higher than Italian (0.18-0.96 μg/L)[13] and Swedish (0.04-0.81 μg/L)[14] populations. While it was lower than Canada[15], Hayderabad, Pakistan[1] and Iran (1.20-1.35 μg/L).[16]

Finally the urinary excretion of Mn in the present study was equal to Swedish population (0.05-2.5 μg/L).[14] While it was lower than Italy (0.12-1.9 μg/L)[13], Canada (0.5-9.8 μg/L)[15], Hyderabad, Pakistan (1.4-1.6 μg/L)[1] and Iran (1.7-1.9 μg/L).[16]

All the above mentioned studies[1,13-16] were focused mainly on drawing comparison between urinary levels of trace elements in the healthy/ non-diabetic individuals and diabetic patients. It was concluded in these studies that the urinary levels of trace elements in diabetic patients were higher than the healthy/non-diabetic individuals.

CONCLUSION

Urinary excretion of zinc, chromium, cobalt and manganese in healthy adults need to be monitored properly to avoid health problems in future.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

Conception and Design:	AUR, SU, MI
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