Short Communication

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Flame-Atomic Absorption Spectrophotometric Determination of Trace Metals in Urine

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The levels (μg l^{-1}) of cadmium, copper, lead, manganese and nickel in the urine of selected students of Lagos State University, Ojo, were determined by flame-atomic absorption spectrophotometry. These levels were compared with control urine samples collected from some randomly selected rural dwellers in Ejigbo, Osun State. The samples were digested and analyzed following standard methods of urine analysis. The trace metals in the urine of students were found to be higher than those in the urine of the rural dwellers. The results revealed statistically significa difference in the Cd, Cu, Mn, and Pb levels between the control samples and those collected from the students.

There has been an increased awareness about the health effect of toxic and other trace metals in relation to environmental exposure (Shulka and Singhal 1984; Kucera *et al* 1995; Pogarev *et al* 1997; Mcisaac and Brun 1998; Starr and Taggart 1998). Several trace metals have been released in large quantities into the environment in industrial areas and urban cities (Adeniyi *et al* 1993; Adeniyi 1995; Rain 1995; Adeniyi 1996). Metal levels are implicated in the pathogenesis of a number of clinical disorders (Kjellstroem 1979; Herman and Horward 1982; Clarkson *et al* 1983; Falahi-Ardakani 1984). Atomic absorption spectrophotometry is a widely used method in the investigation of trace metal concentrations in biological fluids (Elinder *et al* 1978; Legotte *et al* 1980; Hinks *et al* 1982; Alessio *et al* 1993; Bo *et al* 1994; Baranowska 1995). Trace metals in human biological fluids are becoming an increasingly important indicator of the environmental burden of these metals (Kjellstroem 1979; Clarkson *et al* 1983; Falahi-Ardakani 1984; Bo *et al* 1994). The aim of this study was to evaluate the levels of cadmium, copper, manganese, nickel and lead in the urine of Lagos State University students by F-AAS with a view to ascertain the level of pollution as a results of the geographical location of the University.

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Urine from randomly selected volunteers (Lagos State University students and control) was voided into sample bottles, for eight weeks following the methods described earlier in IUPAC 1981. The ages of the volunteers ranged between 19-26 years. The control samples were similarly collected from volunteers resident in Ejigbo, a rural community 200 km from Lagos. The samples were digested in Conc HNO_3 for analysis in triplicate Baranowska (1995) and Legotte *et al* (1980). The levels of trace metals were determined by F-AAS using a Unicam 919 model Atomic Absorption Spectrophotometer. The instrument was calibrated with analytical grade standard metal stock solutions (1 mg dm^{-3}) in replicate. The mean, correlation coefficient, slope and RSD (%) of the standards and samples were calculated.

The mean levels (μg l^{-1}) of trace metals in the urine samples are indicated in Table 1. The ranges observed are 0.44 ± 0.08 to 0.65 ± 0.05; 11.20± 0.84 to 14.40± 0.87; 8.58 ±0.27 to 9.85 ± 0.24; 5.94± 1.31 to 8.75 ± 0.86; 1.35 ± 0.14 to 1.68 ± 0.15 for Cd, Cu, Mn, Ni and Pb respectively for the samples collected from selected students. The average urinary excretion (μg day^{-1}) is also indicated. Similar trends have been observed before (Benedeti *et al* 1992; Bo *et al* 1994; Baranowska 1995; Kucera *et al* 1995) in the analysis of trace metals in urine and other biological fluids and has proved as useful indicator of environmental pollution (Baranowska 1955; Davidson and Secrest 1972; Alessio *et al* 1993). There are statistically significant differences (95% confidence level) between trace metal levels in the urine of the students compared with the control samples (Table 2). This is similar to the observations of (Legotte *et al* 1980; Bo *et al* 1994; Baranowska 1995; Pogarev *et al* 1997) and may be taken as an indication of trace metal pollution. The proximity of Lagos State University to the sprawling Agbara Industrial estate and the very busy Lagos-Badagry expressway may be responsible for the generally higher levels of trace metals observed in the urine of the students (Gammage *et al* 1993; Adeniyi 1996; Pogarev *et al* 1997). It is worthy to note that the relatively high mean levels of copper (8.40 μg l^{-1}), manganese (8.35 μg l^{-1}), nickel (3.82 μg l^{-1}) and lead (0.88 μg l^{-1}) of the control samples are indication that rural communities are equally prone to trace metal contamination possible from non-source points (Rain 1995) and other human activitues (O' Neil 1993; Starr and Taggart 1998).

Table 1

Mean levels of trace metals ($\mu g\ l^{-1}$) in the urine samples and the average urinary excretion ($\mu g\ day^{-1}$).

Volunteer subjects	Cd	Cu	Mn	Ni	Pb
A	0.65±0.05 (0.98±0.08)	12.80 ± 1.10 (19.20±1.65)	9.33 ± 0.64 (14.00±0.96)	7.50 ± 1. 31 (1.25±1.97)	1.48 ± 0. 18 (2.22±0.27)
B	0.65 ±0.05 (0.98±0.08)	12.80 ± 1.79 (19.20±2.69)	9.85 ±0.24 (14.78±0.36)	5.94±1.31 (8.91±197)	1.35±0.14 (2.03±0.21)
C	0.56±0.08 (0.84±0.12)	14.40±0.81 21.60±1.34)	9.53±0.08 (14.30±0.12)	6.88±1.40 (10.32±2.10)	1.68±0.15 (2.52±0.23)
D	0.44±0.08 0.66±0.07	12.40±0.89 (18.60±1.34)	8.70±0.16 (13.05±0.24)	6.87±0.85 (10.31±1.28)	1.42±0.18 (2.13±0.27)
E	0.53±0.13 (0.80±0.20)	12.00±1.41 (18.00±2.12)	9.18±0.59 (13.77±0.89)	7.81±1.11 (11.72±1.68)	1.48±0.18 (2.22±0.21)
F	0.60±0.06 (0.90±0.09)	11.20±0.34 (16.80±1.26)	8.84±0.26 (13.26±0.39)	6.87±0.85 (10.31±1.28)	1.64±0.27 (2.46±0.22)
G	0.56±0.12 (0.84±0.18)	11.20±0.84 (16.80±1.26)	8.58±0.27 (12.87±0.41)	8.75±0.86 (13.13±1.29)	1.64±0.07 (2.46±0.11)
H	0.60±0.06 0.90±0.09	12.80±1.10 (19.20±1.65)	8.78±0.08 (13.17±0.12)	8.44±0.86 (12.66±1.29)	1.42±0.18 (2.13±0.27)
W	ND	8.00±0.00 (12.00±0.00)	8.37±1.51 (12.56±2.27)	3.75±0.85 (5.63±1.22)	0.91±0.09 (1.37±0.14)
X	ND	8.00±0.00 (12.00±0.00)	8.75±0.16 (13.13±0.24)	4.02±0.96 (5.98±1.02)	0.84±0.07 (1.26±0.11)
Y	ND	9.20±1.10 (13.80±1.65)	7.94±0.73 (11.91±1.10)	4.07±0.85 (6.11±1.28)	0.81±0.67 (1.22±1.00)
Z	ND	8.40±0.89 (12.60±1.34)	8.32±0.59 12.48±0.89)	3.44±0.74 5.16±1.05)	0.97±0.20 1.46±0.30)

Notes A-H, Lagos State University Students; W-Z, Control Samples; ND, Not Detected. Figures in parenthesis are the average urinary excretion.

Table 2

Statistical analysis (t-test at 95% confidence level) of trace metals in the urine of the student's vs. control

Cd	Cu	Mn	Ni	Pb
5.03	7.01	2.94	7.09	9.32
(1.81)	(1.81)	(1.81)	(1.81)	(1.81)

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