BIOMONITORING STUDIES FROM TWO DIVERSE POPULATIONS: SIGNIFICANCE IN PREGNANCY

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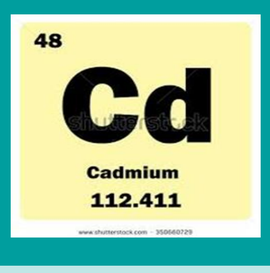
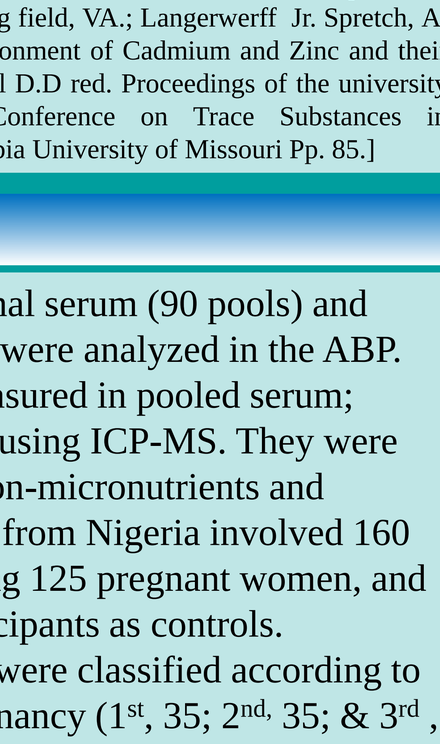
INTRODUCTION

RELEASE OF CADMIUM IN DEVELOPING COUNTRIES



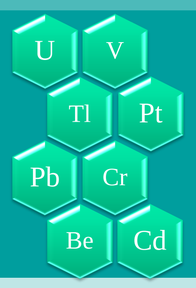


Estimated yearly release of Cd from automobile tyres alone ranges from 5.2 to 6.0 metric tones. (Davies, 1970; Lagerwerff & Spretch, 1971).

[Davies, W.E. (1970). National Inventory of sources and Emission of Cadmium, Nickel and Asbestos. Cadmium Section I Report, PB 192250. Nat. Tech. Info. Spring field, VA.; Langerwerff Jr. Spretch, A. W. (1971) Occurance of environment of Cadmium and Zinc and their uptake by Plants. In: HemPhill D.D red. Proceedings of the university of missiouri, 4th Annul Conference on Trace Substances in Environmental Health. Columbia University of Missouri Pp. 85.]

PREDOMINANT SOURCE OF CADMIUM IN ADVANCED COUNTRIES

Metals Detected Below 25%

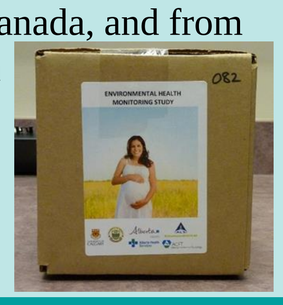


Cadmium poisoning in cigarette smokers

- Cadmium is a ubiquitous chemical that is only poorly excreted with a long biological half-life of approximately 20-30 years, therefore bioaccumulates in tissues.
- It has gained recognition in scientific literature not only in occupational health but also in environmental pollution particularly from cigarette smoke in advanced countries.
- Cadmium is a major constituent of cigarette smoke (Lewis et al, 1972; Schroder, 1976).

Biomonitoring is the measurement of chemicals in the blood, urine or other body fluids of individuals. These measurements contribute vital information about the effect of chemical exposures on human health and facilitate appropriate intervention (1). Owing to the prohibitive cost involved in biomonitoring, many developing countries do not conduct formal biomonitoring programs that are conducted in many developed countries. Rather, they engage in indirect or 'surrogate biomonitoring' programs (SBM).

Studies from two diverse populations, the Alberta Biomonitoring Program (ABP), Canada, and from Nigeria, investigation of cadmium in pregnancy, are presented (2). Previous studies suggest that the potent deleterious effects of Cd may be mitigated by Zn (3, 4).



METHODS

Paired pools of maternal serum (90 pools) and cord blood (90 pools) were analyzed in the ABP. Total metals were measured in pooled serum; including, Fe and Zn, using ICP-MS. They were further divided into non-micronutrients and micronutrients. SBM from Nigeria involved 160 participants comprising 125 pregnant women, and 35 non-pregnant participants as controls. Pregnant participants were classified according to their trimester of pregnancy (1st, 35; 2nd, 35; & 3rd , 55). The third trimester participants were followed up (SBM) until delivery when in addition to measuring serum Cd and Zn levels using AAS in mothers, birth weight (BW), head circumference (HC) and body length (BL) were measured.

RESULTS

Beryllium, cadmium, chromium, lead, platinum, thallium, tungsten, uranium, and vanadium were all detected at less than LOD in 25% of pools in ABP. Iron and zinc were detected in over 25% of the pools and were higher in cord than maternal serum. In the SBM 32 (58%) women delivered normal birth weight babies (NBW), 19 (35%) delivered babies with low birth weight (LBW), while 4 (7%) delivered babies with high birth weight (HBW).

Table 1. Detection Rates < 25% of Metals in Maternal and Cord Serum

IRON (Fe) & ZINC (Zn) WERE BOTH DETECTED AT 100% IN MATERNAL AND CORD SERUM BUT AT HIGHER CONCENTRATION IN CORD SERUM

	Detection Rate (%)	Detection Rate (%)	Remark
Metal	Maternal	Cord	
Beryllium	0	0	
Cadmium	2	0	Environmental health implication- Clean AB?
Chromium	0	0	
Lead	6	3	Implication- ↓ **pollution in AB?**
Platinum	0	0	
Thallium	0	0	
Uranium	0	0	
Vanadium	0	0	

Table 2. Maternal & Cord Serum Metal and Cord Serum in Weighted Mean Concentration and 95% CI

Metal/Micronutrient	Wet weight (ng/mL serum)	
	Maternal	Cord
Aluminum	8.24 (±0.92) $x10^{-1}$	10.24 (±1.33) $x10^{-1}$
Antimony	6.84 (±0.21) $x10^{-1}$	8.33 (±0.44) $x10^{-1}$
Arsenic	2.51 (±0.32) $x10^{-1}$	2.32 (±0.27) $x10^{-1}$
Barium	1.64 (±0.22)	1.26 (±0.29)
Boron	2.04 (±0.09) $x10^{1}$	1.75 (±0.09) $x10^{1}$
Cesium	3.57 (±0.12) $x10^{-1}$	4.58 (±0.18) $x10^{-1}$
Cobalt	4.34 (±0.09) $x10^{-1}$	4.24 (±0.09) $x10^{-1}$
Copper	2.00 (±0.03) $x10^{3}$	0.35 (±0.01) $x10^{3}$
Iron	1.74 (±0.13) $x10^{3}$	4.66 (±0.47) $x10^{3}$
Magnesium	1.59 (±0.02) $x10^{4}$	1.64 (±0.02) $x10^{4}$
Manganese	3.39 (±0.43)	3.86 (±0.18)
Mercury	1.55 (±0.12) $x10^{-1}$	0.97 (±0.07) $x10^{-1}$
Molybdenum	1.16 (±0.08)	1.08 (±0.03)
Nickel	2.54 (±0.20) $x10^{-1}$	4.30 (±0.53) $x10^{-1}$
Selenium	1.02 (±0.03) $x10^{2}$	0.67 (±0.01) $x10^{2}$
Silver	1.55 (±0.27) $x10^{-1}$	0.55 (±0.06) $x10^{-1}$
Strontium	3.06 (±0.07) $x10^{1}$	2.76 (±0.07) $x10^{1}$
Titanium	2.53 (±0.34) $x10^{-1}$	2.67 (±0.32) $x10^{-1}$
Zinc	6.23 (±0.11) $x10^{2}$	10.19 (±0.19) $x10^{2}$

Women who delivered LBW babies had significantly higher serum cadmium levels and lower Zn levels. Zn was significantly reduced in the 3rd trimester compared with the 1st and 2nd trimesters and inversely correlated with Cd (r -0.71; p = 0.000). Additionally, the 3rd trimester women with lowest Zn levels also exhibited the highest Cd levels and were associated with a large proportion of LBW (35 %).

Figure 1: Zinc Pattern in non-pregnant participants and the Three Trimesters of Pregnancy

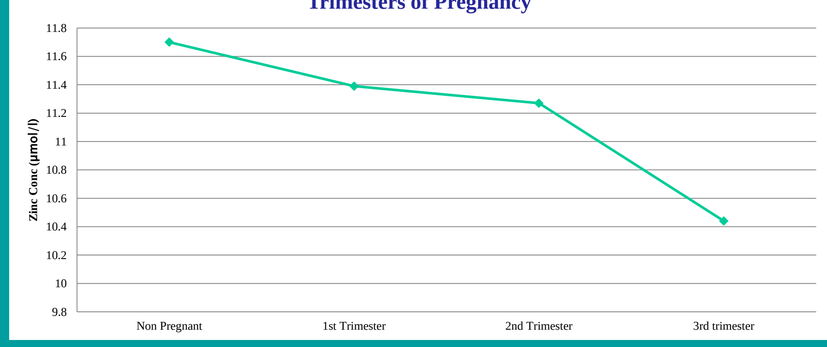
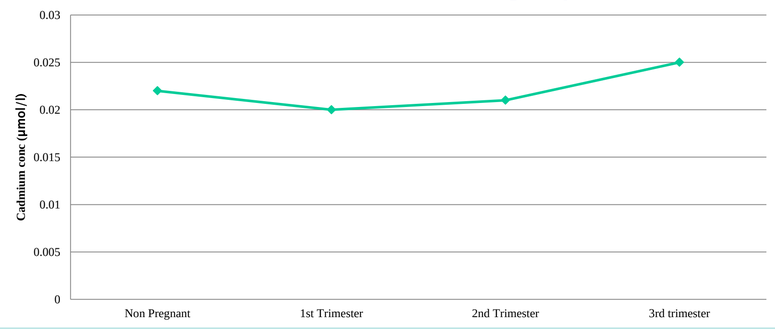


Figure 2: Pattern of Cadmium levels in Non-pregnant participants and the Three Trimesters of Pregnancy



CONCLUSIONS

Cadmium pollution is lower in Canada, with higher pr
higher in Nigeria with attendant lower Zn levels. This
significance, suggesting that populations from countries with elevated cadmium pollution may require monitoring of Zn levels and may benefit from supplemental zinc intake (2,3).

SELECTED REFERENCES

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ACKNOWLEDGEMENT

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