

Chronic Cadmium Exposure on Renal Function in Apparently Healthy Myanmar Subjects

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Background and Aim

- Chronic exposure of cadmium to human may cause a serious health problem in organs such as kidney, bone and lungs.
- Food-borne cadmium is the principal source of exposure in humans, especially in vegetarians and high consumers of rice and aquatic animals.
- It is expected that cadmium exposure may be occurred in non-occupationally exposed normal subjects in Myanmar.
- In this study, we aimed to investigate the link between chronic cadmium exposure and renal function changes in apparently healthy Myanmar subjects.

Materials and Methods

- n = 130 (apparently healthy subjects)
- male subjects = 66 , female subjects =64
- age = 18 – 40 years
- They lived in Yangon, Myanmar.
- According to WHO normal urine cadmium level (i.e., 0.19 μ g/g creatinine), they were divided into
 - exposed group (n=80) and
 - non-exposed group (n=50)
- Blood and urine samples were collected for determination of urinary cadmium, urinary β_2 microglobulin, serum creatinine and estimated GFR (eGFR).
- This study was approved by Research and Ethics Committee, University of Medicine 1, Yangon (073/ UM1, REC.2018).

Urinary cadmium concentration was measured using a graphite-furnace atomic absorption spectrometry (GFAAS) method and then adjusted for urinary creatinine. The urinary and serum creatinine were measured by colorimetric Jaffe method using a commercial kit (Human, Creatinine Liquicolor Complete test kit).



Spectrophotometer (OPTIMA SP-300)



Reagents for measurement of serum and urine creatinine

urinary β_2 microglobulin was measured by Enzyme-Linked Immunosorbant Assay and eGFR was calculated from serum creatinine, age and gender using the CKD Epidemiology Collaboration (CKD-EPI) formula.



Microplate reader (Shenzhen Mindray Bio-Medical Electronics Co., Ltd, Model MR-96A, Germany)



β_2 Microglobulin ELISA Kits (EIA-1789, DRG International, Inc., USA)

Results

Table 1. Basic characteristics of the subjects

Parameters	Non-exposed group (n = 50)	Exposed group (n = 80)
Age (years) (Mean \pm SD)	24 \pm 6	27 \pm 8
BMI (kg/m ²) (Mean \pm SD)	21.67 \pm 2.75	21.85 \pm 2.67
Urinary cadmium (μ g/g Cr) Median (IQR)	0.00 (0.19-0.00)	1.31 (2.12 – 0.84)
Urinary β_2 microglobulin (μ g/g Cr) Median (IQR)	147.3 (234.9 - 77.3)	179.7 (389.4-115.3)
eGFR (ml/min) Median (IQR)	110.75 (127.63-90.53)	104.05 (120.97-85.82)

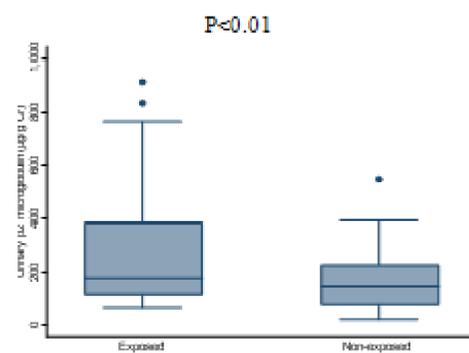


Fig 1. Comparison of urinary β_2 microglobulin level between exposed and non-exposed groups

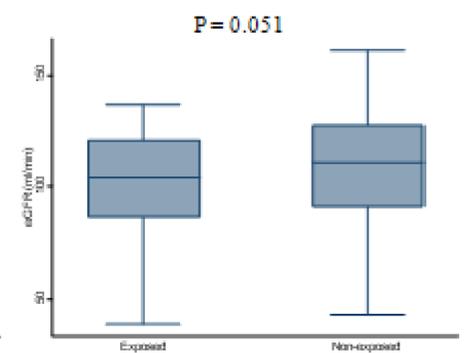


Fig 2. Comparison of eGFR level between exposed and non-exposed groups

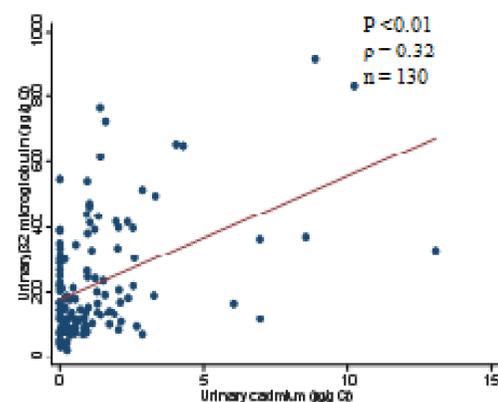


Fig 3. Correlation between urinary cadmium and urinary β_2 microglobulin in all subjects

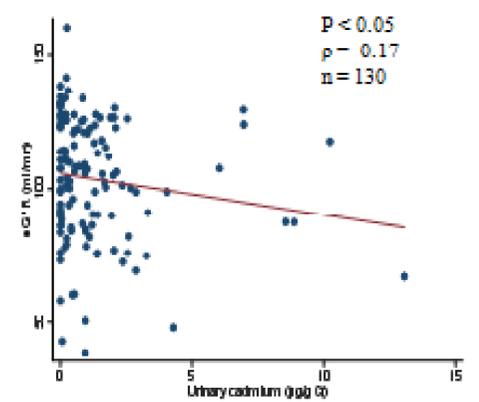


Fig 4. Correlation between urinary cadmium and eGFR in all subjects

Discussion and Conclusion

- The results indicate that higher urinary β_2 microglobulin levels in exposed group might reflect tubular dysfunction and lower levels of eGFR might reflect glomerular dysfunction in chronic cadmium exposure.
- In addition, urine cadmium excretion in both men and women showed a significant positive correlation with urinary β_2 microglobulin excretion.
- These findings indicate that chronic cadmium exposure may increase urinary excretion of low molecular weight protein indicating that the renal tubular dysfunction in apparently healthy subjects.

References

- Agency for Toxic Substances and Disease Registry (ATSDR) (2008) Toxicological Profile for Cadmium (Draft for Public Comment)
- Olsson, I.M., Bensryd, I., Lundh, T., Ottosson, H., Skerfving, S. and Oskarsson, A. (2002) Cadmium in blood and urine—impact of sex, age, dietary intake, iron status, and former smoking—association of renal effects. *Environ Health Perspect.* 110(12), 1185-1190