

Cumulative Arsenic Exposure Index, Nail Arsenic Level and Vibration Perception Threshold in Young Healthy Adolescents Living in Kyone-Pyaw Township

Kyaw-Thet NAING¹, Aye-Aye THEIN¹, Khin-Phyu PHYU², Ohn MAR³, Mya-Mya THWIN⁴

¹Department of Physiology, University of Medicine 2, Yangon, Myanmar

²Department of Medical Research, Yangon, Myanmar

³Department of Physiology, University of Medicine 1, Yangon, Myanmar

⁴Physiology unit, University Sultan Zainal Abidin, Kuala Terengganu, Terengganu, Malaysia

Background and Aim

- Chronic arsenic toxicity becomes an environmental health problem in developing countries including Myanmar since the drinking water is found to be contaminated with **arsenic**.
- The maximum permissible level of arsenic in drinking water is 10 µg/L.¹
- Chronic exposure to arsenic could have effect on the **peripheral nervous system**.
- Nowadays, nail arsenic level is accepted as a biomarker of exposure, especially **chronic exposure**.
- So, this study aimed to investigate **cumulative arsenic exposure index**, **nail arsenic level** and **sensory function** in young healthy adolescents living in Kyone-Pyaw Township

Method

- The **arsenic content of drinking water** was determined by arsenator. The subjects were divided into three groups according to the arsenic contamination level in their drinking water (Group I = 0 to 10 µg/L, Group II = 10.1 to 50 µg/L and Group III = above 50 µg/L)
- Nail arsenic level** was determined by graphite furnace atomic absorption spectrometer (model GBC 932 plus; GBC Scientific Equipment Pty. Ltd., Australia).
- Sensory function (Vibration Perception Threshold)** was assessed by vibrometer, (Diabetik Foot Care India Pvt. Ltd., Chennai, India)
- The **cumulative arsenic exposure index (CAI)** was calculated by the following formula.

$$\text{CAI} = \text{Arsenic concentration in drinking water } (\mu\text{g/L}) \times \text{water drunk per year (L)} \times \text{Duration of drinking water (years)}$$

Results and Discussion

Table 1. Arsenic concentration in drinking water and CAI in the study population

	Arsenic concentration in drinking water (mean ± SD)	Cumulative Arsenic Exposure Index (median, IQR)
Group I (n=45)	5.58±3.65 µg/L	54.75 (26.2-87.6)mg
Group II (n=45)	29.69±14.3 µg/L	258.97 (132.1-408.1)mg
Group III (n=45)	74.51±14.02 µg/L	657 (550.4-817.2)mg

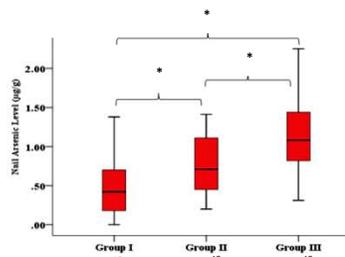


Fig 1. Comparison of nail arsenic level

Comparison was done by Mann-Whitney test. *Indicates significant difference at p < 0.001.

Table 2. Comparison of vibration perception threshold

VPT Median (IQR)	Group I (n=45)	Group II (n=45)	Group III (n=45)	p-value
Index finger (volts)	1 (1-2)	2 (1-2)	2 (1-2)	0.132
Big toe (volts)	2 (2-3)	2 (2-3)	2 (2-3)	0.64

Comparison was done by Kruskal Willis test. Level of significance was set at p value < 0.05.

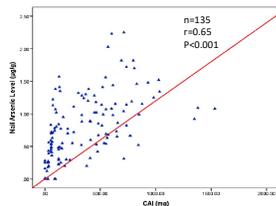


Fig 2. Correlation of between CAI and nail arsenic level in the whole study population

Table 3. Correlation of VPT with CAI and nail arsenic level

VPT	Index finger		Big toe	
	r	p	r	p
CAI	0.141	0.102	0.128	0.139
Nail arsenic level	0.032	0.79	0.031	0.721

Correlations between the parameters were determined by using Spearman's correlation. Level of significance was set at p value < 0.05.

- In this study, 127 out of 135 drinking household wells (94%) were contaminated with arsenic (3-100 µg/L).
- Previous study done by Otto *et al*, (2006) had reported that abnormal sensory functions were detected in people drinking water contaminated with arsenic above 150 µg/L.²

Conclusion

- It could be concluded that the sensory function was normal in this study population exposed to arsenic level up to 100µg/L in drinking water.

Recommendation

- Further follow-up studies will also be necessary to support the results of the present study and, to detect the possible long-term delayed effect of arsenic on the peripheral nervous system if the subjects were still rely on the same water supply as their drinking water sources.

References :

- World Health Organization (2011) Guidelines for drinking-water quality, Geneva: World Health Organization. 4th edition; p.178.
- Otto, D., He, L., Xia Y., Li, Y., Wu, K., Ning Z., Zhao B., Hundell, H., Kwok R., Mumford, J., Geller A. and Wade T. (2006) Neurosensory effects chronic exposure to arsenic via drinking water in Inner Mongolia: II. Vibrotactile and visual function. *Journal of Water and Health*: 4; p.39-48.