

CHEMICAL TOXICOLOGY RESEARCH DIVISION

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The Chemical Toxicology Research Division is engaged in Poison Information Services and research concerned with environmental health such as heavy metals determination, formaldehyde determination and promoting environmental health in arsenic contaminated areas in collaboration with other organizations and departments.

RESEARCH PROJECTS

1. ENVIRONMENTAL HEALTH

1.1 Promoting environmental health in arsenic contaminated areas in Myanmar

This collaborative study between Department of Medical Research and Miyazaki University, Japan had been conducted during August and September 2016 in 7 villages of Thabaung Township, Ayeyarwady Region. A total of 2080 family members from 861 households were interviewed by using questionnaire regarding general health and arsenicosis related symptoms. The ratio of male to female is 1:1.47. General medical examination and examination of arsenicosis related dermatological and neurological symptoms were carried out by collaborating physicians from Dermatological Department and Neuromedical Department of Yangon General Hospital. Dermatological examination included inspection of skin pigmentation, depigmentation, hyperkeratosis, alopecia, nail changes and oral pigmentation. Neurological examination included assessment of pain sensation using toothpick; vibration sensation using tuning fork; and two points discrimination using two pins. Total 1281 hair samples were collected to determine arsenic concentration. The 627 (30.1%) people are using arsenic contaminated tube well less than 50 ppb (<50 ppb) and 515 (24.8%) people are using arsenic contaminated tube well more than 50 ppb (>50 ppb) in dry season. The skin symptoms (history of macules and papules) positive people who drink arsenic contaminated tube well in dry season were 98 (15.6%) in less than 50 ppb group and 64 (12.4%) in more than 50 ppb group. The skin signs positive people who drink arsenic contaminated tube well in dry season were 37 (5.9%) in less than 50 ppb group and 63 (12.2%) in more than 50 ppb group. The impairment of vibration sensation was statistically

significant ($p < 0.05$) between people who drink arsenic contaminated tube well (< 50 ppb) and people who drink arsenic contaminated tube well (≥ 50 ppb) in dry season. Likewise, the impairment of two points discrimination was statistically significant ($p < 0.05$) between people who drink arsenic contaminated tube well (< 50 ppb) and people who drink arsenic contaminated tube well (≥ 50 ppb) in dry season. The findings of this study showed that significant positive relationship between vibration disturbance and tube well arsenic concentration indicated there would be some central nervous system impairment as well as peripheral neuropathy among study subjects.

1.2 Determination of formaldehyde content in clothing and toys for children

Formaldehyde is a colorless, reactive, strong smelling gas at room temperature. It is one chemical in a large family of chemical compounds, CH_2O , called volatile organic compounds (VOCs). Formaldehyde resins are used in fabrics to bind pigments to the cloth, to enhance wrinkle resistance and water repellency, to provide stiffness and used as a fire retardant. They can often be noted by the odor of treated fabric. Increases in temperature (hot days) and increased humidity both increase the release of formaldehyde from coated textiles. Formaldehyde is carcinogenic and allergenic. The limit specified for formaldehyde content is not more than 30 mg/kg or 2.5 mg/L in the clothing and textiles for under 3 years of age. In this study, the levels of formaldehyde in clothing and toys were determined and compared the level of formaldehyde concentrations of clothing and toys. Fifty clothing samples and 50 stuffed toy samples were collected randomly from the various markets. Formaldehyde content were determined by UV/Vis Spectrometry (UVmini-1240, Shimadzu Japan) according to the water extraction method (ISO 1418-1). The result showed that formaldehyde content was in the range of 0 to 4629 mg/kg for clothing samples and 0 to 57 mg/kg for toy samples. Formaldehyde content was found above the permissible limit of 30 mg/kg for under 3 years of age in 9 clothing samples and 1 toy sample. The level of formaldehyde concentration was higher in clothing sample than toy samples. This study showed the formaldehyde concentration in clothing and toys for children under 3 years of age and recommended that new clothing should be washed before wearing to reduce the level of formaldehyde.

1.3 Quantification of heavy metals in white rice (milled rice) and brown rice (un-hulled rice) from Thabaung Township

Rice is the major staple food of Myanmar. In general, there are two kinds of rice as white and brown rice. The evidence suggested that brown rice may contain more heavy metals especially arsenic than white rice. When the permissible concentration of heavy metals in the body exceeds, they can cause serious health disorders. This study aimed to determine the concentrations of heavy metals in milled rice and un-hulled rice from Thabaung Township. A cross-sectional study was conducted at four villages namely Konetangyi (ကုန်းတန်းကြီး), Yaleygyi (ရေလဲကြီး), Dale-et (ဒလယ်အဲ) and Shannkwin (ရှမ်းတွင်း) of Thabaung Township in Ayeyarwady Region. Six samples each of milled rice and un-hulled rice were collected. The concentration of ten kinds of heavy metals was determined by inductively coupled plasma - optical emission spectrometry (ICP-OES) (Perkin Elmer) Optima 8000. Arsenic was not detected in both un-hulled rice and milled rice samples. Cadmium was detected in both un-hulled rice and milled rice samples within the permissible limit but one un-hulled rice sample contained Cd level which was above Maximum Allowable Concentration (MAC). Lead was detected above MAC in all un-hulled rice and milled rice samples but one milled rice sample contained Pb level which was below MAC. Chromium was detected in all un-hulled rice and milled rice samples but all these values

were within the MAC. Cobalt was not detected in both un-hulled rice and milled rice but except in one milled rice sample. Zinc, Copper and Manganese were detected above MAC in all un-hulled rice and milled rice samples. Nickel was detected above MAC in all un-hulled rice samples and 3 milled rice samples but it was below MAC in 3 milled rice samples. Iron was detected above MAC in all un-hulled rice samples and one milled rice sample, but it was above MAC in 4 milled rice samples. Therefore increased concentration of microelements required for nutrition in un-hulled rice may be good for health, but the increased concentration of toxic metals may be hazardous.

Table (1). Distribution of concentrations of heavy metals (mean \pm SD) in milled rice grain samples and un-hulled rice grain samples (ND = not detected)

Metals	Konetangyi				Yaylegyi				Dale-et		Shannkwin		Maximum Allowable Concentration (MAC)
	Yay-Sin-Thee-Htat		Mhee-Kaut		Mhee-Kaut		Shwe-Thwe-Yin		Shwe-Thwe-Yin		Shwe-Thwe-Yin		
	milled rice	un-hulled rice	milled rice	un-hulled rice	milled rice	un-hulled rice	milled rice	un-hulled rice	milled rice	un-hulled rice	milled rice	un-hulled rice	
As	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	200 (ng/g)
Cd	49.3 ± 2.2	205.8 ± 9.3	43.59 ± 0.64	78.06 ± 1.38	55.00 ± 1.43	104.6 ± 0.24	61.79 ± 1.04	59.91 ± 1.43	29.76 ± 0.40	81.46 ± 0.71	78.93 ± 0.14	188.4 ± 4.39	200 (ng/g)
Pb	0.67 ± 0.01	7.500 ± 0.03	0.05 ± 0.00	3.88 ± 0.03	0.67 ± 0.00	5.26 ± 0.05	1.40 ± 0.00	6.58 ± 0.05	0.26 ± 0.01	4.03 ± 0.04	3.86 ± 0.03	98.29 ± 0.86	0.2 (μg/g)
Cr	0.008 ± 0.01	0.25 ± 0.00	0.15 ± 0.18	0.11 ± 0.00	ND	0.24 ± 0.01	0.55 ± 0.02	0.23 ± 0.00	ND	0.13 ± 0.00	ND	0.512 ± 0.01	1 (μg/g)
Zn	71.98 ± 0.15	371.4 ± 1.44	65.64 ± 1.1	239.8 ± 5.45	67.53 ± 1.48	303.5 ± 8.10	80.74 ± 1.47	329.8 ± 6.15	50.53 ± 1.734	212.1 ± 6.40	158.3 ± 3.62	4170 ± 30.35	50 (μg/g)
Cu	41.87 ± 0.18	223.1 ± 2.03	20.69 ± 0.11	117.2 ± 1.03	29.72 ± 0.48	181.6 ± 2.84	49.66 ± 1.09	199.1 ± 3.72	22.21 ± 0.17	120.9 ± 1.87	121.0 ± 1.28	421.1 ± 1.69	10 (μg/g)
Ni	1.25 ± 0.00	4.03 ± 0.01	1.48 ± 0.01	5.00 ± 0.07	0.91 ± 0.02	10.57 ± 0.07	1.50 ± 0.02	10.88 ± 0.14	0.55 ± 0.01	4.82 ± 0.09	2.69 ± 0.02	59.04 ± 1.09	1.5 (μg/g)
Fe	2.40 ± 0.05	5.51 ± 0.29	1.98 ± 0.08	8.86 ± 0.43	1.75 ± 0.10	139.0 ± 2.34	6.16 ± 0.34	8.11 ± 0.11	0.67 ± 0.30	9.02 ± 0.40	ND	14.20 ± 0.61	5 (μg/g)
Mn	19.75 ± 0.13	16.24 ± 0.37	25.89 ± 0.36	27.11 ± 0.35	21.03 ± 0.21	23.73 ± 0.00	14.18 ± 0.17	9.21 ± 0.08	18.65 ± 0.19	11.78 ± 0.07	9.61 ± 0.22	18.38 ± 0.07	5 (μg/g)
Co	ND	ND	ND	ND	ND	ND	0.005 ± 0.001	ND	ND	ND	ND	ND	0.01 (μg/g)

1. OTHERS

2.1 Analgesic effect of rhizomes and leaves of *Angiopteris evecta* (Giant fern)(၆၁၀:၆၆၃၁) on animal model

Plants are one of the sources of many modern drugs. Myanmar has many plants which have great medicinal values. Among them, *Angiopteris evecta*, Say-myin-khwar, is one of the traditional indigenous medicinal plants, which has many pharmacological properties such as antimicrobial activity, antihyperglycemic and hair growth activity. The aim of this study is to determine the analgesic effect of rhizomes and leaves of *Angiopteris evecta* (Giant fern) on albino mice. The plant material, *Angiopteris evecta*, was collected from Western Bago Yoma, Thabaung Township. The rhizomes and leaves of *Angiopteris evecta* were air-dried under shade for 7 days. Methanol extraction was done by soxhlet method. Yield percentage of rhizomes and leaves were 20.82 and 9.74 respectively. Acetic acid was used by intraperitoneally to cause pain in mice model and, the number of writhings produced was

observed and recorded. The percent inhibitions of writhings were calculated in comparison to those of control. The standard analgesic, diclofenac, at the dose of 50 mg/kg body weight (bwt) reduced the number of writhings by 61%. Methanolic extract of rhizomes at the dose of 100 mg/kg Bwt reduced the number of writhings by 30%; at the dose of 200 mg/kg Bwt by 0% and; at the dose of 400 mg/kg Bwt by 21%, respectively. Methanolic extract of leaves at the dose of 100 mg/kg Bwt reduced the number of writhings by 24%; at the dose of 200 mg/kg Bwt by 35% and; at the dose of 400 mg/kg Bwt by 22%, respectively. Methanolic extract of leaves at the dose of 200 mg/kg Bwt showed the best analgesic activity among the extracts. However, both methanolic extracts of rhizomes and leaves showed no statistically significant analgesic effect ($p \geq 0.05$) compared to the standard drug, diclofenac. Therefore, the rhizomes and leaves of *A. evecta* had analgesic effect comparable to that of standard analgesic, diclofenac.

2.2 Serodetection of hepatitis C among HIV patients in Mingalardon specialist hospital

Coinfection with hepatitis C virus in human immunodeficiency virus infected individuals results in increased hepatic complication. In the era of antiretroviral therapy, liver-related death among patients with HIV is the most prevalent non-AIDS related cause. HIV and HCV share common pathways of mode of transmission. The aim of this study was to detect hepatitis C in HIV infected patients and to find out the coinfection rate in HIV infected patients from Mingalardon Specialist Hospital. The study was done at Molecular Technology Applications division at Department of Medical Research from January 2016 to November 2016. A total of 150 participants including 83 males and 67 females were studied. Blood samples were tested for anti-HCV by enzyme linked immunosorbent assay (ELISA) method. The ages of study population ranged from 19 years to 77 years. Anti-HCV was positive in 15 (8 males, 7 females) patients and the prevalence was found to be 10%. Seroprevalence of anti-HCV was slightly higher in males 10.8% (8/83) than females 9.0% (7/67). The highest anti-HCV positivity was found in age group 30-40 years (46.6%) followed by (26.7%, each) in 19-29 years and 41-50 years. No anti HCV was detected in 51-60 years and more than 60 years age group. The rate of HCV coinfection in HIV positive patients was higher among married patients (12.1%) than single patients (8.3%). Among HCV coinfection patients, 80% (n=12) was reported as low level education than high level education (20%) (n=3) and more common in urban (53.3%) than rural area (46.7%). Coinfection with HCV had shown statistically significant association ($p=0.05$) with IVDU history (57.1%). Only 12.5% (n=2) was found anti-HCV in the patient who had blood transfusion history. Out of 52 patients who had history of skin piercing, anti-HCV was detected in 17.3% (n=9). Among HCV coinfecting patients, mean CD4 count was 493.87cells/mm³. No HCV coinfection was encountered in patient with CD4 count less than 200 cells/mm³. The present study demonstrated that HCV coinfection was more common in male gender, 30-40 year age group, residence from urban area, married people, low education status, history of receiving body piercing practice and significantly associated with IVDU. The findings of this study would be indicative of a portion of hepatitis C coinfection among HIV patients in Myanmar.

SERVICES PROVIDED

ACADEMIC

Sr.	Name	Course	Responsibility
1.	Dr. San San Htwe	MMedSc (Pathology) MMedTech (MedLab Tech) MMedSc (Med Juris) MMedSc (Biochemistry) MMedSc (Pharmacology) MNSc MPharm	Teaching
2.	Daw Mya Mar Lar	MMedTech (MedLab Tech) MMedSc (Med Juris) MMedSc (Biochemistry) MMedSc (Pharmacology) MNSc MPharm	Teaching
3.	Dr. Phyo Wai Zin	MMedTech (MedLab Tech) MMedSc (Med Juris) MMedSc (Biochemistry) MMedSc (Pharmacology) MNSc MPharm	Teaching

Poison Information Service

The Poison Information regarding chemical poisonings, chemicals used in the commercial products and chemical safety in the residential and the working environment was given by telephone using Poison Information Monograph, International Programme on Chemical Safety (IPCS) and Micromedex.