Genetic polymorphisms in glutathione S-transferase (GST) superfamily and arsenic metabolism in residents of the Red River Delta, Vietnam

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Abstract: To elucidate the role of genetic factors in arsenic metabolism, we investigated associations of genetic polymorphisms in the members of glutathione S-transferase (GST) superfamily with the arsenic concentrations in hair and urine, and urinary arsenic profile in residents in the Red River Delta, Vietnam. Genotyping was conducted for GST ω1 (GSTO1) Ala140Asp, Glu155del, Glu208Lys, Thr217Asn, and Ala236Val, GST ω2 (GSTO2) Asn142Asp, GST π1 (GSTP1) Ile105Val, GST μ1 (GSTM1) wild/null, and GST θ1 (GSTT1) wild/null. There were no mutation alleles for GSTO1 Glu208Lys, Thr217Asn, and Ala236Val in this population. GSTO1 Glu155del hetero type showed higher urinary concentration of As^{V} than the wild homo type. Higher percentage of DMA^{V} in urine of GSTM1 wild type was observed compared with that of the null type. Strong correlations between GSTP1 Ile105Val and arsenic exposure level and profile were observed in this study. Especially, heterozygote of GSTP1 Ile105Val had a higher metabolic capacity from inorganic arsenic to monomethyl arsenic, while the opposite trend was observed for ability of metabolism from As^{V} to As^{III}. Furthermore, other factors including sex, age, body mass index, arsenic level in drinking water, and genotypes of As (+ 3 oxidation state) methyltransferase (AS3MT) were also significantly co-associated with arsenic level and profile in the Vietnamese. To our knowledge, this is the first study indicating the associations of genetic factors of GST superfamily with arsenic metabolism in a Vietnamese population.

Author Keywords: Arsenic; Genetic polymorphism; Glutathione S-transferase ω1 (GSTO1); GST θ1 (GSTT1); GST μ1 (GSTM1); GST π1 (GSTP1); GST ω2 (GSTO2); Vietnam

Index Keywords: alanine; arsenic; asparagine; aspartic acid; drinking water; glutamic acid; glutathione transferase; glutathione transferase M1; glutathione transferase O1; glutathione transferase O2; glutathione transferase P1; glutathione transferase T1; isoleucine; lysine; methyltransferase; threonine; unclassified drug; valine; adolescent; adult; age; aged; arsenic poisoning; article; body mass; child; controlled study; environmental exposure; female; gene deletion; gene mutation; genetic association; genetic polymorphism; genotype; hair level; heterozygote; human; human tissue; male; metabolic capacity; normal human; nucleotide sequence; null allele; school child; sex; toxicogenetics; toxicokinetics; urine level; Viet Nam; water contamination; wild type; Adolescent; Adult; Age Factors; Aged; Arsenic; Body Mass Index; Child; Female; Genotype; Glutathione Transferase; Hair; Humans; Male; Methyltransferases; Middle Aged; Polymorphism, Genetic; Rivers; Sex Factors; Vietnam; Water Pollutants, Chemical; Young Adult

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Chemicals/CAS: alanine, 56-41-7, 6898-94-8; arsenic, 7440-38-2; asparagine, 70-47-3, 7006-34-0; aspartic acid, 56-84-8, 6899-03-2; glutamic acid, 11070-68-1, 138-15-8, 56-86-0, 6899-05-4; glutathione transferase, 50812-37-8; isoleucine, 7004-09-3, 73-32-5; lysine, 56-87-1, 6899-06-5, 70-54-2; methyltransferase, 9033-25-4; threonine, 36676-50-3, 72-19-5; valine, 7004-03-7, 72-18-4; AS3MT protein, human, 2.1.1.137; Arsenic, 7440-38-2; Glutathione Transferase, 2.5.1.18; Methyltransferases, 2.1.1.-; Water Pollutants, Chemical
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